

OLIMPIADA DE CHIMIE
etapa județeană/municipiului București
23 martie 2024
Clasa a X-a

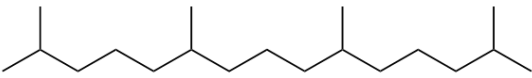
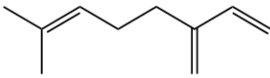
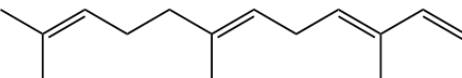
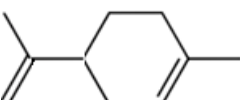
BAREM DE EVALUARE ȘI DE NOTARE

Orice modalitate de rezolvare corectă a cerințelor va fi punctată corespunzător.

SUBIECTUL I

35 de puncte

A.10 de puncte

Structură compus chimic	Denumire I.U.P.A.C. compus chimic	
	2,6,10,14-tetrametilpentadecan	2p
	7-metil-3-metilen-1,6-octadienă	2p
	3,7,11-trimetil-1,3,6,10-dodecatetraenă	3p
	4-(2-propenil)-1-metilciclohexenă	3p

B.10 de puncte

a. formula chimică: $C_{40}H_{56}$, $M = 536 \text{ g/mol}$

% C = 89,553% ; % H = 10,447%

2p

b. $C_{\text{primar}} : C_{\text{secundar}} : C_{\text{terțiar}} : C_{\text{cuaternar}} = 10:6:14:10 = 5:3:7:5$

4p

c. oxidarea blândă $11[O] \Rightarrow n_1 = 22/3 \text{ mol KMnO}_4$

oxidarea energetică $40[O] \Rightarrow n_2 = 80/5 \text{ mol KMnO}_4$

$n_1 / n_2 = 11/24$

4p

C.15 de puncte

a. $d_{\text{aer}} = M_{\text{amestec gazos}} / M_{\text{aer}} \Rightarrow M_{\text{amestec gazos}} = 28,9 \cdot 1,822 = 52,6558 \text{ g/mol}$

$p_A : p_X = 2:1 \Rightarrow n_A : n_X = 2:1 \Rightarrow 52,6558 = \frac{2}{3} \cdot (14n + 2) + \frac{1}{3} \cdot [14(n - 1)] \Rightarrow n=4$

A: C_4H_{10} și X: C_3H_6

6p

b)



2p

c)

$n\text{-C}_4\text{H}_{10} \rightleftharpoons i\text{-C}_4\text{H}_{10}$		
I	1	-
C	a	-
E	1-a	a

$$K_c = \frac{C_{i\text{-C}_4\text{H}_{10}}}{C_{n\text{-C}_4\text{H}_{10}}} \Rightarrow K_c = \frac{\frac{a}{V}}{\frac{1-a}{V}} \Rightarrow a=0,8$$

5p

procentaj molar 20% n-butan și 80% izobutan

2p

SUBIECTUL al II-lea

20 de puncte

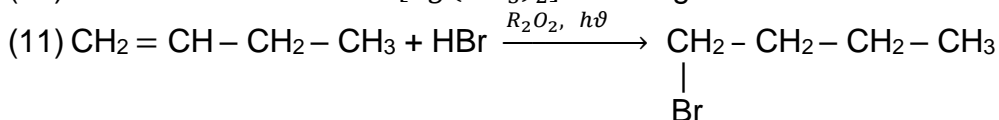
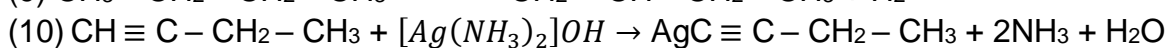
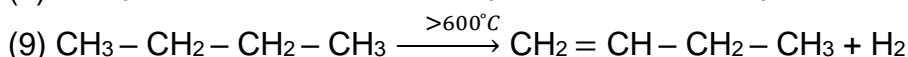
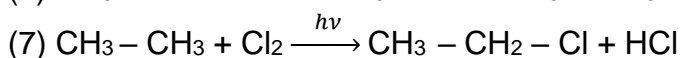
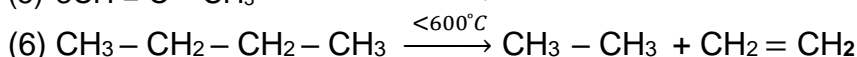
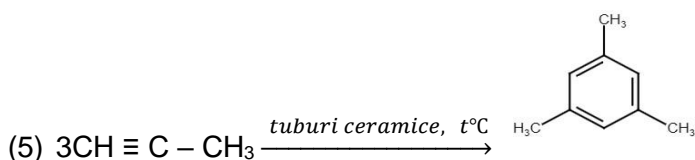
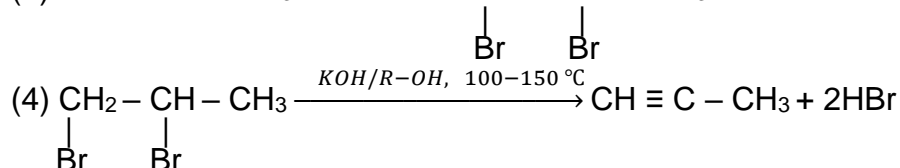
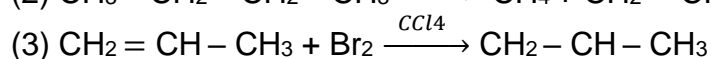
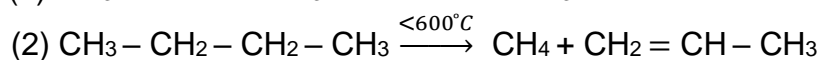
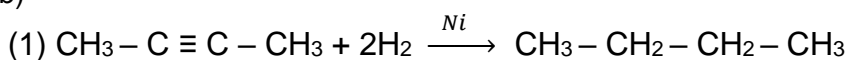
- a) $d_{\text{aer}(\min)} = 1$ și $d_{\text{aer}(\max)} = 2 \Rightarrow M_{(\min)} = 28,9 \text{ g/mol}$ și $M_{(\max)} = 57,8 \text{ g/mol} \Rightarrow M_{D,H,L,E} \{29-57\}$
D, H, L - gaze
A, D și L – hidrocarburi nesaturate
A, L – izomeri
 raportul molar al produșilor de ardere

4p

\Rightarrow **A** – 2-butină, **D** – propenă, **H** – etan, **K** – 1-butenă, **L** – 1-butină

5p

b)



11p

SUBIECTUL al III-lea

25 de puncte

A. **17 de puncte**

a) $n = \frac{pV}{RT} = 4 \text{ mol } \text{H}_2$

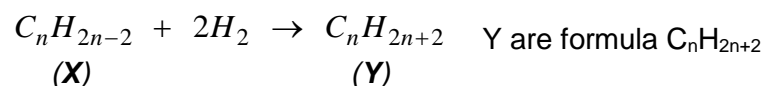
1p

1 mol hidrocarbură **X** adăunează 2 mol de $\text{H}_2 \rightarrow$ prezintă două legături π

1p

X – hidrocarbură aciclică, are formula $\text{C}_n\text{H}_{2n-2}$,

0,5p

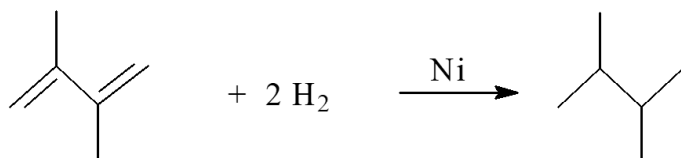


0,5p

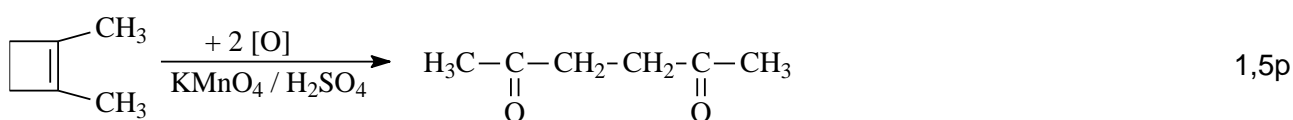
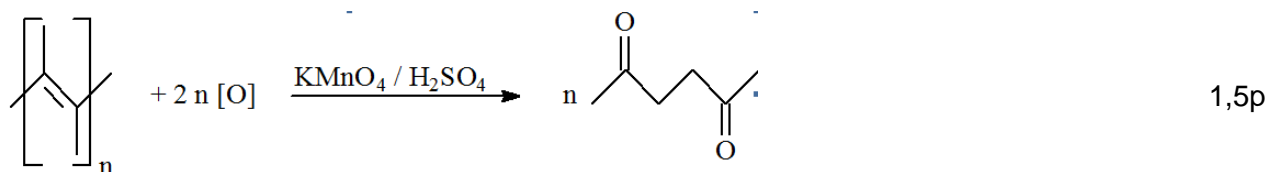
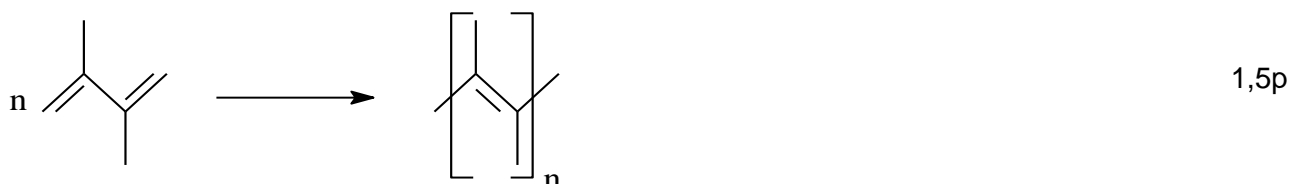
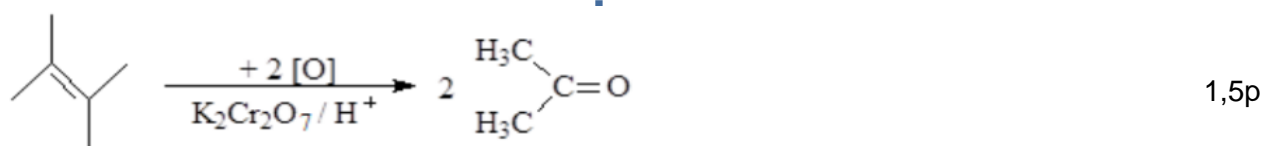
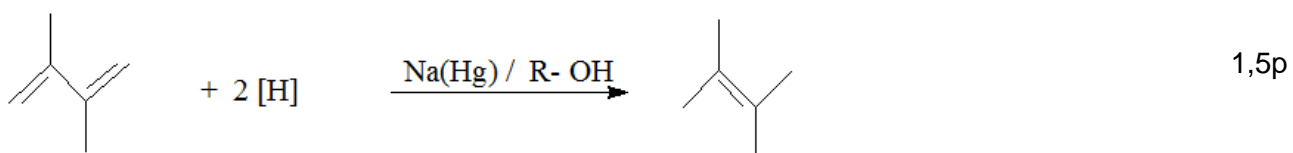
$M_X = M_Y - \frac{4,651}{100} \cdot M_Y \Rightarrow 14n - 2 = 14n + 2 - \frac{4,651}{100} \cdot (14n + 2) \Rightarrow n = 6$ **X** = C_6H_{10}

2p

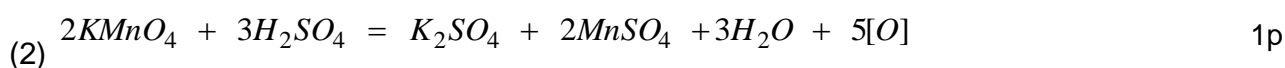
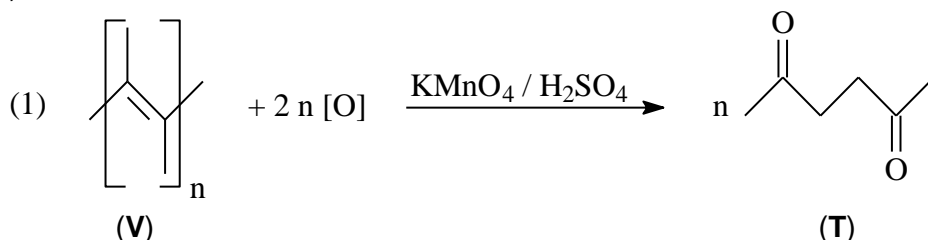
b)



1,5p



c)

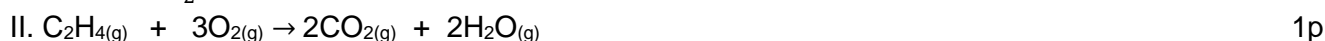
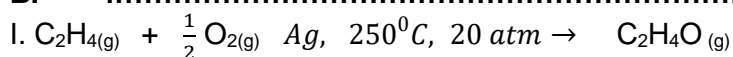


Pentru a oxida 32,8 g compus **V**, din ecuația (1) rezultă $n_{[\text{O}]} = 0,8 \text{ mol}$. 1p

Din ecuația (2) pentru $n_{[\text{O}]} = 0,8 \text{ mol}$ rezultă $n_{\text{KMnO}_4} = 0,32 \text{ mol}$ 0,5p

$$V_s = \frac{n_d}{C_M} = 0,64 \text{ L} \quad \text{soluție KMnO}_4 \text{ de concentrație } 0,5\text{M} \quad 0,5\text{p}$$

B.8 de puncte



III. $\text{C}_2\text{H}_{4(\text{g})}$ netransformată

Considerăm 100 mol amestec gazos final: $\text{C}_2\text{H}_4\text{O} - 14 \text{ mol}$, $\text{H}_2\text{O} - 0,8 \text{ mol}$, $\text{N}_2 - 64 \text{ mol}$,
 C_2H_4 netransformată + $\text{CO}_2 - 21,2 \text{ mol}$

1p

14 mol $\text{C}_2\text{H}_4\text{O} \rightarrow 14 \text{ mol C}_2\text{H}_4$ se transformă în oxid de etenă

0,5 p




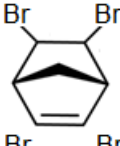
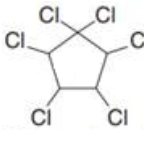
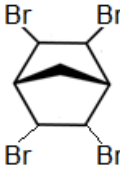

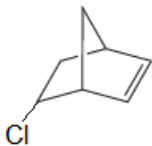



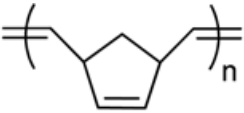
7 mol O ₂ se consumă în reacția de formare a oxidului de etenă	0,5 p
0,8 mol H ₂ O → 0,4 mol C ₂ H ₄ arde	0,5 p
0,8 mol CO ₂ se formează prin ardere	0,5 p
1,2 mol O ₂ se consumă în reacția de ardere	0,5 p
7 + 1,2 = 8,2 mol O ₂ introdus în reactor	0,5 p
nr. mol CO ₂ introdus în reactor = 2x nr. mol O ₂ → nr. mol CO ₂ introdus în reactor = 16,4 mol	0,5 p
nr. mol CO ₂ final = 16,4 + 0,8 = 17,2 mol	0,5 p
nr. mol C ₂ H ₄ netransformată = 21,2 - 17,2 = 4 mol	0,5 p
nr. mol C ₂ H ₄ introdusă în reactor = 14 + 0,4 + 4 = 18,4 mol	0,5 p

%cantitatea de etena introdusă în reactor transformată în oxid de etenă = 76,08% 1 p

SUBIECTUL al IV-lea

20 de puncte

a)

A	HC≡CH	1p	G		1p	L		1p
B		1p	H		1p	M		1p
D	H ₂ C=CH-Cl	1p	I		1p	N		1p
E		1p	J		1p	N₁		1p
F		1p	K		1p			

b) $1121,85 \cdot 50/100 = 560,925$ mg **M** pur, practic $\Rightarrow 2,025$ mmol **M** practic $\Rightarrow 2,025 \cdot \frac{100}{75} \cdot \frac{100}{90} = 3$ mmol **M** teoretic $\Rightarrow 3$ mmol **B** teoretic

$300 \cdot \frac{100}{80} = 375$ mg **D** teoretic $\Rightarrow 6$ mmol **D** teoretic $\Rightarrow 6$ mmol **A** teoretic

A este în exces \Rightarrow din 3 mmol **B** $\Rightarrow 3$ mmol **N**

6p

Barem elaborat de:

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