

OLIMPIADA LA CHIMIE
etapa raională/municipală, clasa a XI-a
Soluții și barem de evaluare

Nr.	Rezolvare	Punctajul	Total
1.	<p>Test. Fiecare răspuns corect – 2 puncte Răspunsuri corecte: 1. c; 2. b; 3. e; 4. d; 5. b; 6. d; 7. b; 8. d; 9. d; 10. b.</p>	20 p.	
2.	<p>Problema 1.</p> <p>1. Se stabilește formula moleculară a substanței A. Din datele problemei $n(\text{Br}) = 1 = W(\text{Br})/A_r(\text{Br})$. Aplicăm formula: $n(\text{E}) = W(\text{E}) \times A_r(\text{Br})/A_r(\text{E}) \times W(\text{Br})$; $n(\text{C}) = 0,22 \times 80/12 \times 0,734 = 2$ $n(\text{H}) = 0,046 \times 80/1 \times 0,734 = 5$; Formula substanței A: $\text{C}_2\text{H}_5\text{Br}$</p> <p>Notă: Fiecare formulă de structură corectă – 1,5 p. + 0,5 p. – denumire corectă</p> <p>2. $\text{CH}_3\text{-CH}_2\text{-Br} + \text{NaOH} \xrightarrow[\text{NaBr}]{\text{H}_2\text{O}} \text{CH}_3\text{-CH}_2\text{-OH}$ (B) 2,0 p.</p> <p>3. $\text{CH}_3\text{-CH}_2\text{-OH} \xrightarrow[\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4]{[O]} \text{CH}_3\text{-CH=O} + \text{H}_2\text{O}$ (C) 2,0 p.</p> <p>4. $\text{CH}_3\text{-CH=O} + \text{CH}_3\text{-CH=O} \xrightarrow{\text{OH}} \text{CH}_3\text{-CH(OH)-CH}_2\text{-CHO}$ (D) 2,0 p.</p> <p>5. $\text{CH}_3\text{-CH(OH)-CH}_2\text{-CHO} \xrightarrow{\text{H}_2\text{O}} \text{CH}_3\text{-CH=CH-CH=O}$ (E) 2,0 p.</p> <p>6. $\text{CH}_3\text{-CH=CH-CH=O} + 2\text{H}_2 \rightarrow \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-OH}$ (F) 2,0 p.</p> <p>7. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-OH} \xrightarrow[\text{KCr}_2\text{O}_7 + \text{H}_2\text{SO}_4]{[O]} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH=O}$ (G) 2,0 p.</p> <p>8. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH=O} + \text{CH}_3\text{-CH=O} \xrightarrow{\text{NaOH}} \text{CH}_3\text{-(CH}_2)_2\text{-CH(OH)-CH}_2\text{-CH=O}$ (H) 2,0 p.</p> <p>9. $\text{CH}_3\text{-(CH}_2)_2\text{-CH(OH)-CH}_2\text{-CH=O} \xrightarrow{\text{H}_2\text{O}} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH=CH-CH=O}$ (L) 2,0 p.</p> <p>10. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH=CH-CH=O} \xrightarrow[\text{KMnO}_4 + \text{H}_2\text{SO}_4]{[O]} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-COOH}$ (M) 2,0 p. +HOOC-COOH (N) 2,0 p.</p> <p>11. Denumirile substanțelor: A – bromoetan (bromură de etil), B – etanol; C – etanal, D – 3-hidroxibutanal; E – but-2-en-al (aldehidă crotonică); F – butan-1-ol; G – butanal; H – 3-hidroxi-hexanal; L – hex-2-en-al; M – acid butanoic; N – acid etandioic (acid oxalic)</p>		25 p.
3.	<p>Problema 2.</p> <p>Pentru rezolvarea exercițiului se analizează ecuațiile reacțiilor propuse în ordinea: 6), 5), 7), 8), 9), 2), 4), 3), 1), 10), 11), 12).</p> <p>Notă: Fiecare reacție corectă – 1,0 p. + 0,35 p. – denumire corectă</p> <p>6) $\text{CaO} + 3\text{C} \xrightarrow{2200^\circ\text{C}} \text{CaC}_2 + \text{CO}$ 1,35p.</p> <p>5) $\text{CaC}_2 + 2\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{HC}\equiv\text{CH}$ 1,35p.</p> <p>7) $\text{HC}\equiv\text{CH} + \text{H}_2\text{O} \xrightarrow[\text{H}_2\text{SO}_4]{\text{Hg}^{2+}} \text{CH}_3\text{-CH=O}$ 1,35p.</p> <p>8) $\text{CH}_3\text{-CH=O} \xrightarrow{[O]} \text{CH}_3\text{COOH} + \text{H}_2\text{O}$ 1,35p.</p> <p>9) $\text{CH}_3\text{-CH=O} + \text{H}_2 \xrightarrow{\text{Ni}, t} \text{CH}_3\text{-CH}_2\text{-OH}$ 1,35p.</p> <p>2) $\text{CH}_3\text{-CH}_2\text{-OH} + \text{CH}_3\text{COOH} \xrightleftharpoons{\text{H}_2\text{SO}_4(\text{o})} \text{CH}_3\text{-COOC}_2\text{H}_5 + \text{H}_2\text{O}$ 1,35p.</p> <p>4) $\text{HC}\equiv\text{CH} + \text{CH}_3\text{COOH} \xrightarrow{(\text{CH}_3\text{COO})_2\text{Hg}} \text{CH}_2=\text{CH-O-C(O)CH}_3$ 1,35p.</p> <p>3) $\text{CH}_2=\text{CH-O-C(O)CH}_3 + \text{H}_2 \xrightarrow{\text{Ni}, t} \text{CH}_3\text{-CH}_2\text{-O-C(O)CH}_3$ 1,35p.</p> <p>1) $\text{CH}_3\text{-CH=O} + \text{CH}_3\text{-CH=O} \xrightarrow{\text{NaOH}} \text{CH}_3\text{-CH(OH)-CH}_2\text{-CH=O} \rightarrow \text{CH}_3\text{-CH=CH-CH=O}$ 1,35p.</p> <p>10) $\text{HC}\equiv\text{CH} + \text{HC}\equiv\text{CH} \xrightarrow{\text{CuCl}, \text{NH}_4\text{Cl}, 80^\circ\text{C}} \text{H}_2\text{C=CH-C}\equiv\text{CH}$ 1,35p.</p> <p>11) $\text{H}_2\text{C=CH-C}\equiv\text{CH} + \text{HCl} \rightarrow \text{CH}_2=\text{CH-C(Cl)=CH}_2$ 1,35p.</p> <p>12) $n\text{CH}_2=\text{CH-C(Cl)=CH}_2 \xrightarrow{\text{Init.}} (-\text{CH}_2\text{-CH=C(Cl)-CH}_2-)_n$ (neopren) 1,35p.</p> <p>Denumirile substanțelor notate cu litere: h – carbură de calciu; e – etină (acetilenă); a – etanal (acetaldehidă); d – acid etanoic (acid acetic); c – etanol (alcool etilic); b – acetatul de etil; f – acetatul de vinil; i – 3-hidroxibutanal, k – but-2-en-al (aldehidă crotonică); l – but-1-en-3-ină (vinilacetilenă); j – 2-cloro-buta-1,3-dienă (cloropren); polimer (neopren - cauciuc cloroprenic).</p> <p>Precizarea condițiilor în care au loc reacțiile (pentru fiecare reacție 0,2 puncte). 1,8 p.</p>	20 p.	

4.

Problema 3

1. a) $M(A) = M(O_2) \cdot 3,75; M(A) = 32 \cdot 3,75 = 120$

Formula generală a seriei benzenului: C_nH_{2n-6}

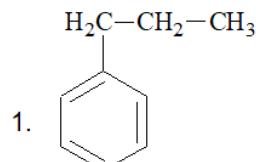
$$12n + 1(2n - 6) = 120; n = 9$$

Formula brută: C_9H_{12}

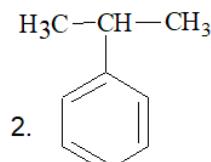
35p.

2p.

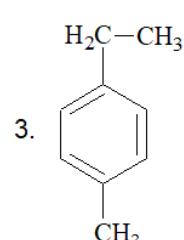
b) Izomerii C_9H_{12} (fiecare formulă de structură corectă - 1,5p + 0,5 p. – denumire corectă).



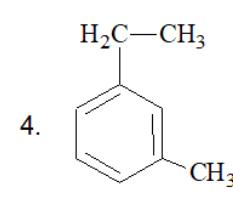
propilbenzen



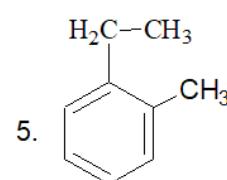
izopropilbenzen



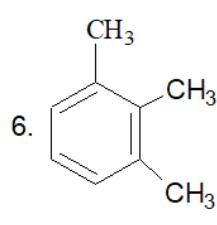
1-ethyl-4-methylbenzen



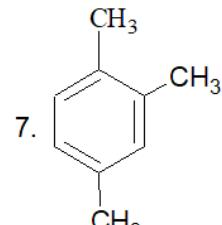
1-ethyl-3-methylbenzen



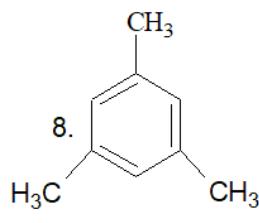
1-ethyl-2-methylbenzen



1,2,3-trimethylbenzen

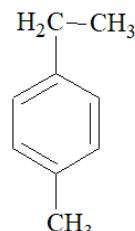


1,2,4-trimethylbenzen



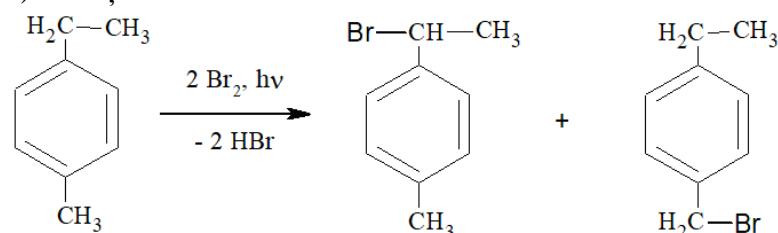
1,3,5-trimethylbenzen

16p.

c) Hidrocarbura A:

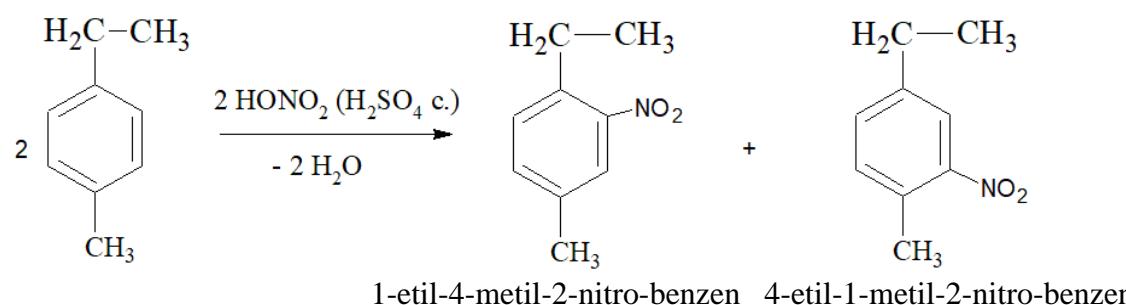
1-ethyl-4-methylbenzen

3p.

d) Reacția de bromurare:

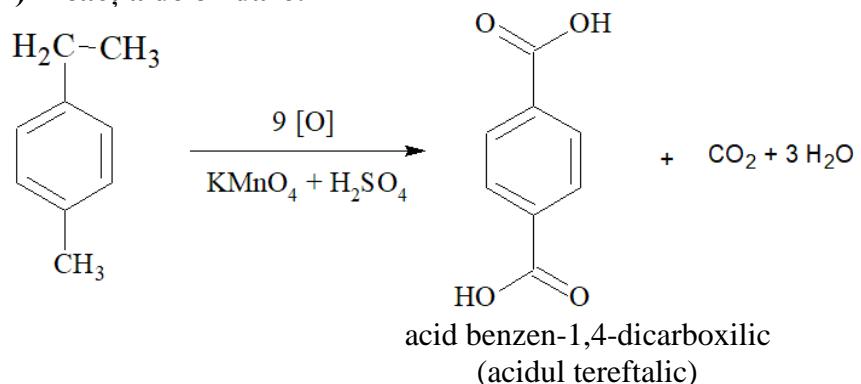
1-bromo-1-(4-tolyl)-ethan 1-(4-bromometil-fenil)-ethan

4p.

e) Reacția de nitrare:

4p.

f) Reacția de oxidare:



2p.

1. Izopropilbenzenul (cumenul) este materia primă în sinteza fenolului și a acetonei:

