

Epreuve écrite

Examen de fin d'études secondaires 2002	Nom et prénom du candidat:
Section: BC	Corrigé
Branche: CHIMIE	

1

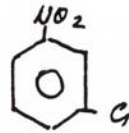
I. Composés aromatiques

12 points

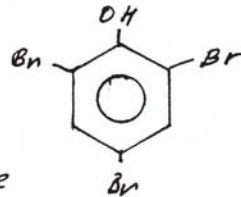
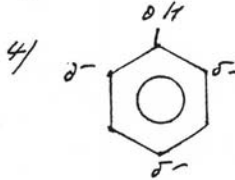
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m-chloro-nitrobenzène



2,4,6 tribromo-  
phénol

\* groupement donneur de doublet par effet M: oriente en o et p

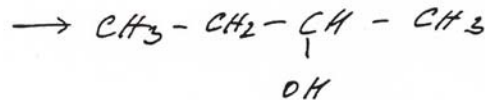
\* -OH: groupement donneur de doublet: augmente la densité électronique sur le cycle benzénique et favorise une attaque électrophile

II. Composés oxygénés

17 points



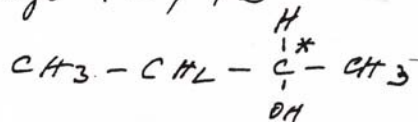
but-1-ène



butan-2-ol (alcool II)

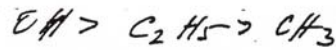
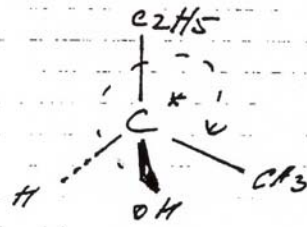
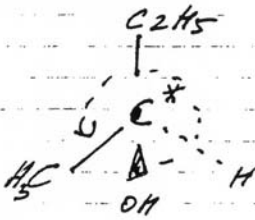
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2. oui



II. 2 Suite:

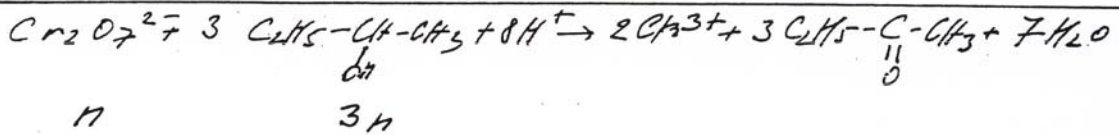
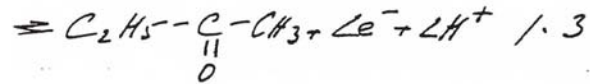
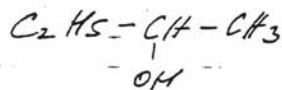
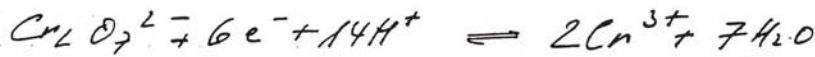
(2)



(S)-butan-2-ol

(R)-butan-2-ol

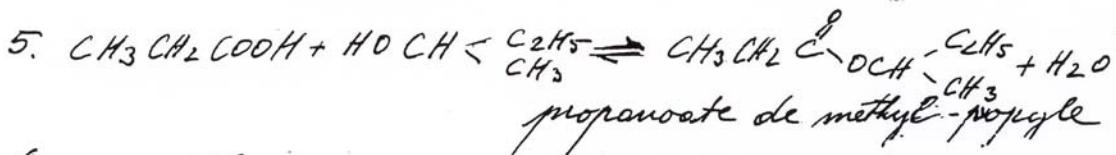
3. oxydation: alcool II  $\rightarrow$  cétone



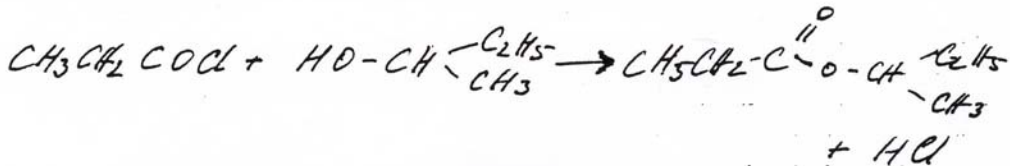
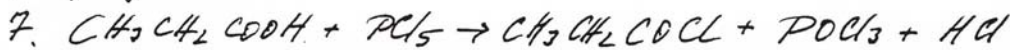
$$4. \frac{3 \text{ ROH}}{1 \text{ Cr}_2\text{O}_7^{2-}} = \frac{3 \text{ mol}}{1 \text{ mol}} = \frac{0,06 \text{ mol}}{x} \left\{ \begin{array}{l} m(\text{alcool}) = 4,44 \text{ g} \\ M(\text{alcool}) = 74 \text{ g/mol} \end{array} \right.$$

$$n(\text{Cr}_2\text{O}_7^{2-}) = 0,02 \text{ mol}$$

$$V = n/c = \frac{0,02 \text{ mol}}{0,5 \text{ mol/l}} = 0,04 \text{ l} \cong \underline{40 \text{ ml}}$$



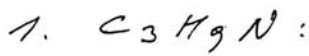
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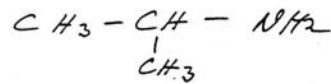
### III Amines

(45) points

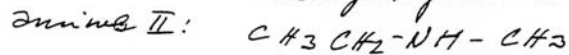
(3)



propylamine  
propanamine



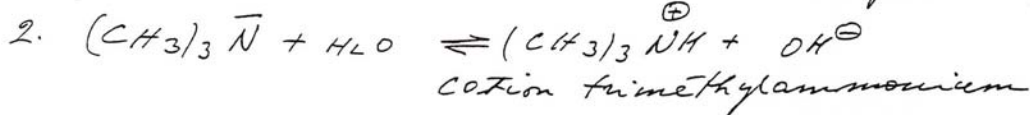
méthylethylamine



N-méthylethylamine



triméthylamine



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3.  $pH = 11,4 \rightarrow pOH = 2,6$

$$[OH^-] = 10^{-2,6} = 2,5 \cdot 10^{-3} \text{ mol/l}$$



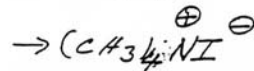
$$0,0975 \quad \text{excès} \quad 2,5 \cdot 10^{-3} \quad 2,5 \cdot 10^{-3}$$

$$K_b = \frac{[(CH_3)_3NH^{\oplus}][OH^-]}{[(CH_3)_3N]} = \frac{(2,5 \cdot 10^{-3})^2}{0,0975}$$

$$K_b = 6,4 \cdot 10^{-5} \rightarrow pK_b = 4,2$$

$$\rightarrow pK_a = 9,8$$

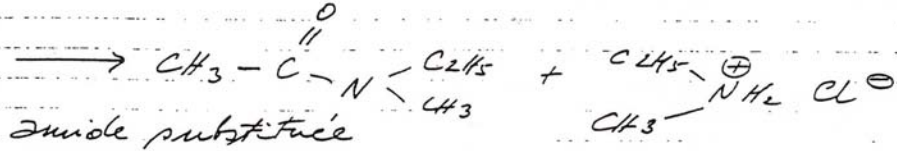
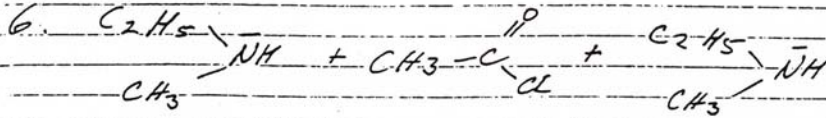
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iodure de tétraméthyl-  
ammonium

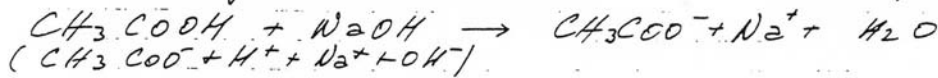
III. Suite

(4)



IV. Dosages acide-base:

(16 pts)



$\text{p}K_1 = 4,75$      $\text{p}K_2 = 15,74$  :  $\Delta \text{p}K_2 \gg 3$  : p. totale

$$C_A \cdot V_A = C_B \cdot V_B \rightarrow C_A = \frac{0,05 \text{ mol} \cdot \text{l}^{-1} \cdot 40 \cdot 10^{-3}}{20 \cdot 10^{-3}} = \underline{\underline{0,1 \text{ mol/l}}}$$

3. a) pH départ:  $\text{CH}_3\text{COOH}$  = acide faible!

$$K_2 = 1,78 \cdot 10^{-5}$$

$$x^2 + 1,78 \cdot 10^{-5} x - 1,78 \cdot 10^{-5} \cdot 0,1 = 0$$

$$x = [\text{H}_3\text{O}^+] = 1,325 \cdot 10^{-3} \Rightarrow \text{pH} = \underline{\underline{2,88}}$$

b) point de demi-équivalence:  $\text{pH} = \text{p}K_2 = 4,75$ .

c) pH après ajout de 30 ml NaOH:



$$V = 20 \text{ ml}$$

$$V = 30 \text{ ml}$$

$$c = 0,1 \text{ mol/l}$$

$$c = 0,05 \text{ mol/l}$$

$$n_0 = 2 \cdot 10^{-3} \text{ mol}$$

$$n_0 = 1,5 \cdot 10^{-3} \text{ mol} \longrightarrow$$

$$= 1,5 \cdot 10^{-3} \text{ mol}$$

$$n_1 = 5 \cdot 10^{-4} \text{ mol}$$

$$c = \underline{\underline{0,01 \text{ mol/l}}}$$

$$(V = 50 \text{ ml})$$

$$\underline{\underline{0,03 \text{ mol/l}}}$$

$$\text{pH} = 4,75 + \log \frac{0,03 \text{ mol/l}}{0,01 \text{ mol/l}}$$

$$\underline{\underline{\text{pH} = 5,23}}$$

d) pH à l'équivalence:

(5)

tout  $\text{CH}_3\text{COOH}$  transformé en  $\text{CH}_3\text{COO}^-$

pH > 7!

(= base faible)

$$pK_b = 9,25 \rightarrow K_b = 5,62 \cdot 10^{-10}$$



$$n = 2 \cdot 10^{-3} \text{ mol} \quad n = 2 \cdot 10^{-3} \text{ mol}$$

$$\rightarrow n = 2 \cdot 10^{-3} \text{ mol}$$

$$V_{\text{tot}} = 60 \text{ ml}$$

$$x = [\text{OH}^-] = 4,325 \cdot 10^{-6} \text{ mol/l}$$

$$c = 0,0333 \text{ mol/l}$$

$$pOH = 5,36 \rightarrow \underline{\underline{pH = 8,64}}$$

4. phénolphthaleïne :  $pK_a = 9,4$

$$pK_a - 1 < \text{pH (ou P.E.)} < pK_a + 1$$

$$[8,64]$$

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