MC 1.D 2.B 3.A. 4.C 5.A 6.C 7.B 8.C 9.A 10.C

55

Chemistry 3A3B

Organic Chemistry Test #2.

Answers.

1 [6]

a) 4-ethyl-2,4-dimethylheptane (1)

b) 5,5-dibromo-3,3,4,4-tetrachlorohexanoic acid (1)

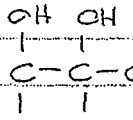
c) methyl propanoate (1)

d) 1-chloro-2-methyl benzene (1)
(chloro toluene)

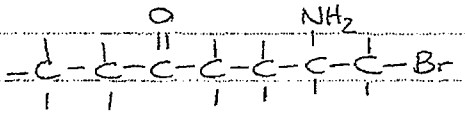
e) trans-2-pentene (1)

f) Sodium butanoate. (1)

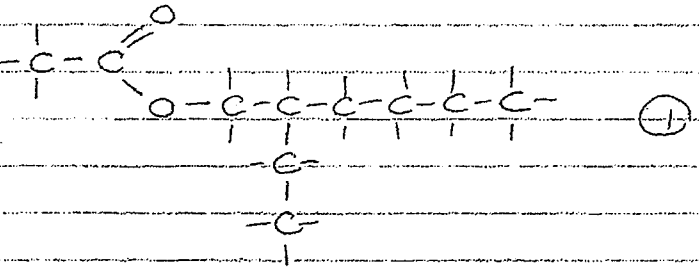
2 [6]

a) 

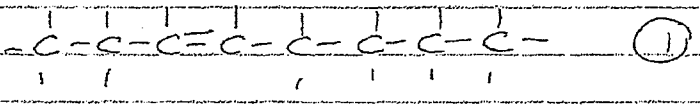
(1)

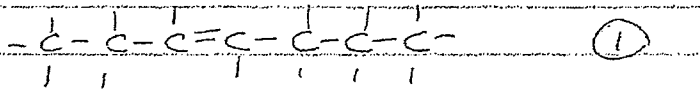
b) 

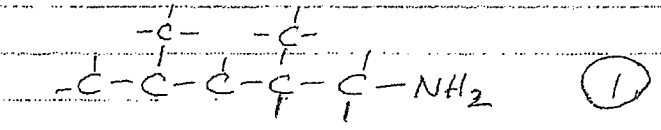
(1)

c) 

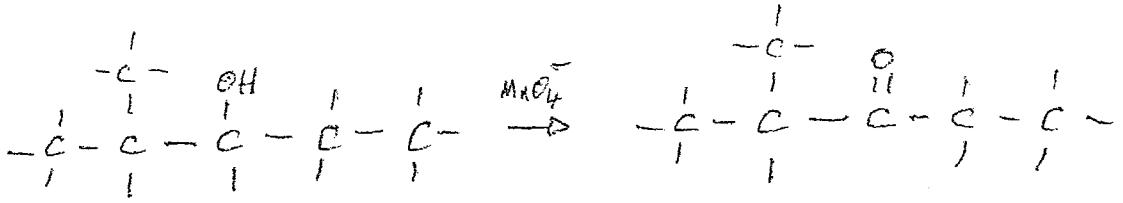
(1)

d) 
(1)

e) 
(1)

f) 

(1)

3. (a) 

8

$$C_6H_4O \rightarrow C_6H_{12}O + 2H^+ + 2e^- \quad (1)$$

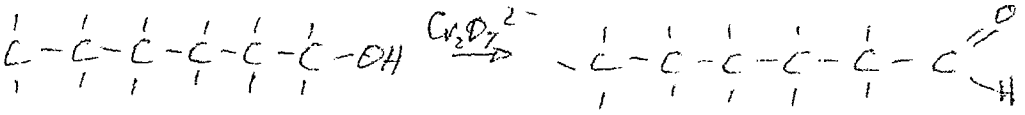
$$5\left(CH_3CHCH_3CHOHCH_2CH_3 \rightarrow CH_3CHCH_3COCH_2CH_3 + 2H^+ + 2e^-\right)$$

$$2\left(MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O\right)\left(\tfrac{1}{2}\right)$$

$$5\,CH_3CHCH_3CHOHCH_2CH_3 + 2MnO_4^- + \overset{6}{\cancel{16}}H^+ \rightarrow 5\,CH_3CHCH_3COCH_2CH_3 + 2Mn^{2+} + \cancel{16}H^+ + 8H_2O$$

$$\Rightarrow 5\,CH_3CHCH_3CHOHCH_2CH_3(\ell) + 2MnO_4^-(aq) + 6H^+(aq) \rightarrow 5\,CH_3CHCH_3COCH_2CH_3(\ell) + 2Mn^{+2}(aq) + 8H_2O(\ell) \quad \left(1\tfrac{1}{2}\right)$$

obs: A clear purple solution is added to a clear and colourless liquid. The solution decolourizes and forms a bilayer with two clear and colourless liquids. (1)

(b) 

$$C_6H_{14}O \rightarrow C_6H_{12}O + 2H^+ + 2e^-$$

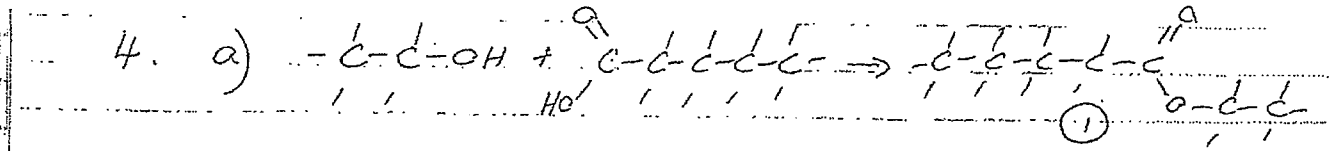
$$3\left(CH_3(CH_2)_4CH_2OH \rightarrow CH_3(CH_2)_4CHO + 2H^+ + 2e^-\right)(1)$$

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O \quad \left(\tfrac{1}{2}\right)$$

$$3\,CH_3(CH_2)_4CH_2OH + Cr_2O_7^{2-} + \overset{8}{\cancel{14}}H^+ \rightarrow 3\,CH_3(CH_2)_4CHO + 2Cr^{3+} + \cancel{8}H^+ + 7H_2O$$

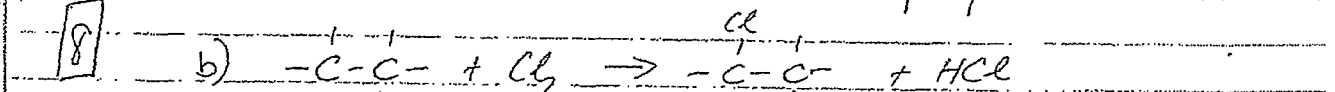
$$\Rightarrow 3\,CH_3(CH_2)_4CH_2OH(\ell) + Cr_2O_7^{2-}(aq) + 8H^+(aq) \rightarrow 3\,CH_3(CH_2)_4CHO(aq/\ell) + 2Cr^{3+}(aq) + 7H_2O(\ell) \quad \left(1\tfrac{1}{2}\right)$$

obs: A clear orange is added to a colourless liquid. A deep green solution is formed. (Partial bi-layer with a clear and colourless liquid on a deep green solution) (1)

4. a) 

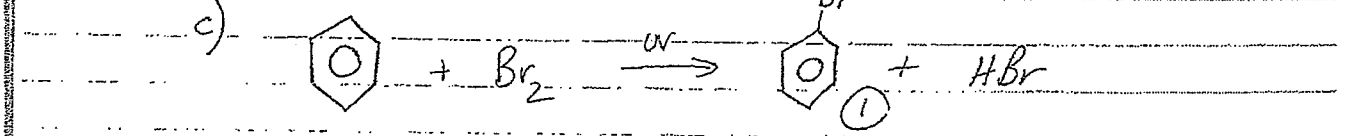
ethyl pentanoate (1)

8

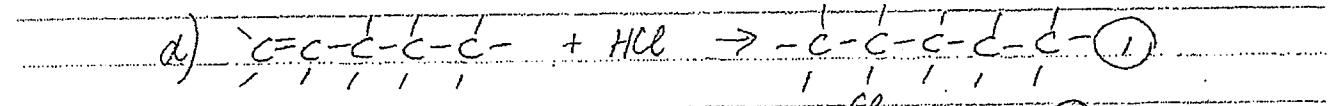
b) 

chloroethane (1)

* May show fully substituted.

c) 

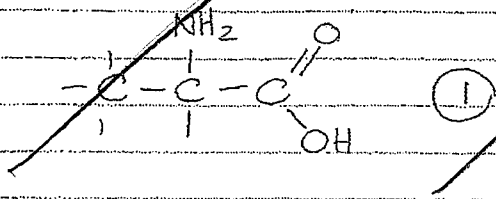
bromobenzene (1)

d) 

2-chloropentane (or 1-chloropentane)

5. a) An alpha amino acid is where the $-NH_2$ group is on the carbon adjacent to the $-COOH$ group. (1)

[2]

b)  (1)

6. $C_xH_yO_2N_w + O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O + wNO_2$

1.279g → 1.600g, 0.770g

$N = 0.1697g$.

CO_2: $m = 1.60\,g$, $M = 44.0\,g.mol^{-1}$, $n = m/M = 1.600/44.0 = 3.64\times10^{-2}\,mol$.

$n(C) = n(CO_2) = 3.64\times10^{-2}\,mol$.

$m(C) = n\times M = 3.64\times10^{-2}\times 12. = 0.4364\,g$. (1)

H_2O: $m = 0.770g$, $M = 18.0\,g\,mol^{-1}$, $n = m/M = 0.770/18.0 = 4.28\times10^{-2}\,mol$.

$n(H) = 2\times n(H_2O) = 8.56\times10^{-2}\,mol$.

[8]

$m(H) = n\times M = 0.0855\times 1.008 = 0.08624\,g$. (1)

$m(O) = m(sample) - (m(C) + m(H) + m(N))$

$= 1.279 - (0.4364 + 0.08624 + 0.1697)$

$= 0.587\,g$.

$n(O) = m/M = 0.587 \div 16 = 0.0366\,mol$. (1)

$n(N) = m/M = 0.1697/14 = 0.0121\,mol$ (1)

	C	H	O	N
mol	0.0364	0.0856	0.0366	0.0121
÷ by smallest	0.0364/0.0121	0.0856/0.0121	0.0366/0.0121	0.0121/0.0121
ratio	3	7	3	1

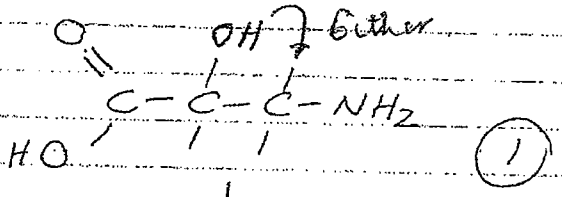
EF $C_3H_7O_3N$ (1)

b) EFW = (3×C) + (7×H) + (3×O) + (1×N)
= (12×3) + (7) + (3×16) + 14.
= 105 g.mol^{-1} (1)

$$MF = \frac{MFW}{EFW} \times EF$$

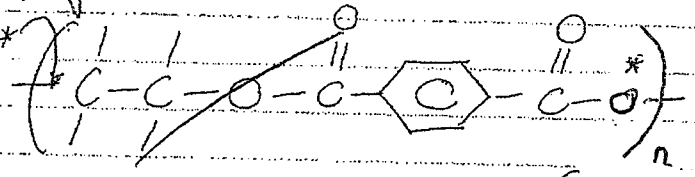
$$= \frac{105}{105} \times C_3H_7O_3N$$

$$= C_3H_7O_3N \quad (1)$$

c) 

(1)

(7) a) "O" may be here!

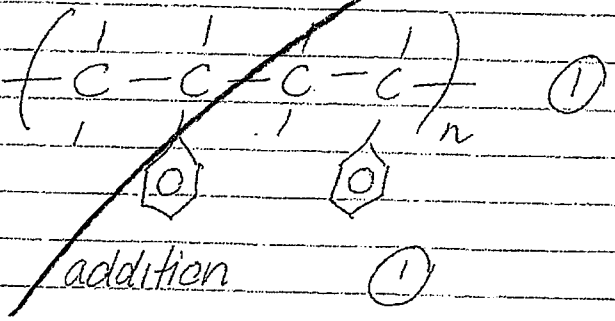


(1)

(1)

5

condensation (1)

b) 

(1)

addition (1)

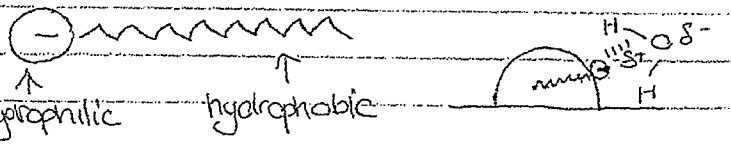
(8) a) Sodium hydroxide (any metal hydroxide) (1)

[3] b) $Na^+ {}^-OOC(CH_2)_{16}CH_3$ (1)

c) Saponification (1)

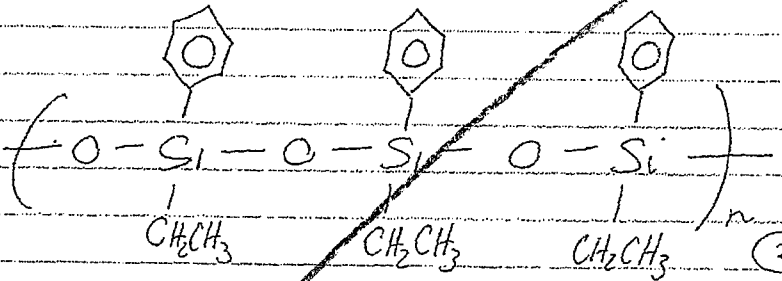
(9) "Soap" anions have a structure with a negatively charged ionic head, and a long carbon chain as the tail. (1) The charged head is hydrophillic - 'water loving' and the tail, with its dispersion forces, hydrophobic - 'water hating' (1) The hydrophobic tail lodges in the grease, leaving the charged 'hydrophilic' head exposed. H_2O can then interact with the head through ion-dipole interactio Thus the grease can become "water soluble". (1)

[3]



(10)

[2]



(2)

(11) a) They are all condensation polymers (forms of nylon) (1)

[4] b) Nylon 6,10 (1)

c) Nylon 6,6 (1)

b) N-H and C=O groups are close together (½)
Symetrical packing of chains (½)