Name: John Nelson Emmanuel
College: Science
Department: Geology
Matric no. 19/SC/14/008

1 (i) HCOOH → Methanoic acid Ans
HCOOCCH₃ → Pentan - 1,5 - dioic acid

$HCOOH$ → Methanoic acid
$HCOOCCH_3$ → Pentan - 1,5 - dioic acid
$CH_3CH_2CH_2COOH$ → Butanoic acid
HO_2C-CO_2H → Ethanedioic acid
$CH_3(CH_2)_4COOH$ → Hexanoic acid
$CH_3CH=CHCH_2CH_2COOH$ → Hex-4-enoic acid.

2 (i) Physical appearance: All simple aliphatic carboxylic acid are to C_{10} are liquid of room temperature. Most carboxylic acids are solid at room temperature although acetic acid (glacial ethanoic acid) freeze to an ice like solid below room temperature.

(ii) Boiling point: Boiling point increase with increasing relative molecular mass. Aromatic carboxylic acids are crystaline solid and have have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

(iii) Solubility: lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water. The water solubility of the acid decrease while the relative molecular mass increases. All carboxylic acids are soluble in organic solvents.

3 (i) from Petroleum
(ii) from Carbon (ii) Oxide.

(4) Synthetic preparations

(i) Oxidation of primary alcohol and aldehydes

this method can be used to prepare carboxylic acids using the oxidizing agents in acidic solution ... i $KMnO_4$ or $K_2Cr_2O_7$

RCH_2OH —[O] excess acid / $KMnO_4$→ $RCHO$ —[O]→ $RCOOH$

(ii) Carbonation of grinard reagent:

Aliphatic carboxylic acids are obtained by bubbling carbon (iv) oxide into the grinard's reagent and then hydrolysed with dilute acid. R may be 1° 2° + 3°.

$RMgX + CO_2 \ (C_2H_5)_2O \rightarrow RCOOMgBr$ —H_2O dil. acid→ $RCOOH + MgBr.OH$

In preparation of Benzoic acid the reagent is added to solid carbon (iv) oxide (dry ice) which also serves as a coolant to the reaction mixture.

$C_6H_5MgBr + CO_2$ —$(C_2H_5)_2O$→ $C_6H_5COOMgBr$ —H_2O/H^+→ $C_6H_5COOH + Mg$...

(iii) Hydrolysis of nitriles (cyanides) or esters:

$RCN + 2H_2O \xrightarrow{H^+} RCOOH + NH_4^+$

(R → alkyl or aryl radical)

$RCOOR$ —H_2O/H^+ reflux→ $RCOOH + R'OH$

$C_6H_5CH_2CN + 2H_2O \xrightarrow{H^+} C_6H_5CH_2COOH + NH_4^+$

$CH_3CH_2COOCH_3$ —H_2O/H^+ reflux→ $CH_3CH_2COOH + CH_3OH$.

(iv) Reduction to primary alcohol:

Carboxylic acids are very difficult to reduce by catalytic hydrogenation or ~~dissolving~~ dissolving metals but lithium tetrahydrido aluminate (iii) and diborane form intermediate compounds with them which liberate the alcohol on hydrolysis.

$RCOOH + 3LiAlH_4$ —$(C_2H_5)_2O$→ $(RCH_2O) + Al... + 2LiAlO_2 + 4H$...

↓ H_2O

$4RCH_2OH + Al(OH)_3 + LiOH$.

$CH_3CH_2CH_2COOH$ —$LiAlH_4$→ $CH_3CH_2CH_2CH_2OH$

Butanoic acid. Butanol

(xvi) Decarboxylation:
These involves removal of the carboxyl group from the acid to give a hydrocarbon or its derivative. Thermal decarboxylation is when carboxylic acids with strong electron attracting groups decarboxylate on heating to 100-150°C while others decarboxylate on heating to when their salts are heated with soda lime.

$CH_3CH_2CH_2COONa + NaOH \xrightarrow{fuse} CH_3CH_2CH_3 + Na_2CO_3$

Kolbe synthesis.

$2CH_3CH_2COONa + 2H_2O \xrightarrow{Electrolysis / aq\ CH_3OH} CH_3(CH_2)_2CH_3 + 2CO_2 + 2NaOH + H_2$

(iii) Esterification:
In the presence of strong acid catalyst, carboxylic acids react with alcohols to form esters.

$CH_3CH_2CH_2COOH + CH_3CH_2CH_2OH \xrightarrow{H^+} CH_3CH_2CH_2COOCH_2CH_2CH_3 + H_2O$