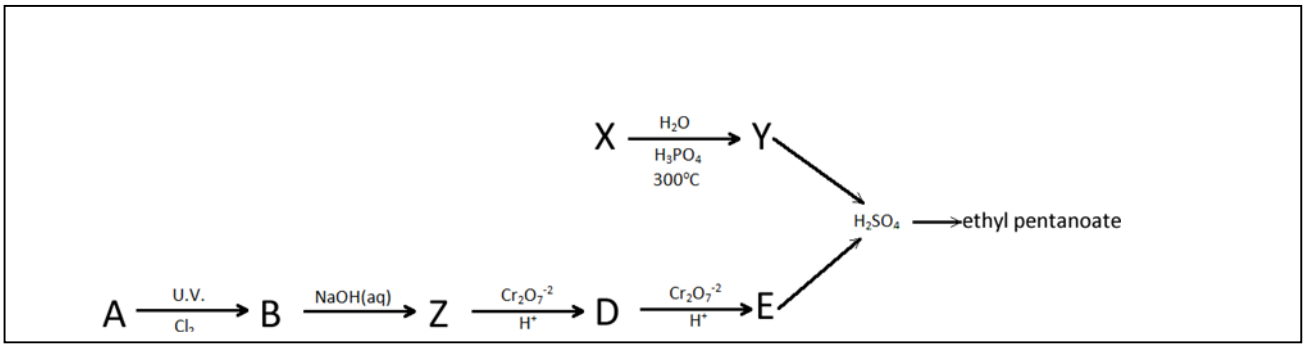
Revision 5 Reaction pathways, enthalpy and galvanic cells



1) Consider the reaction pathways shown above.

a) Draw the structural formulae and name the following (***Naming aldehydes is not on the course)***

b) What type of reaction is

i. A →B *Substitution*

ii. B → Z *Substitution*

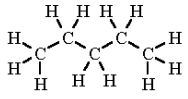
iii. Z → D *Oxidation*

iv. D → E *Oxidation*

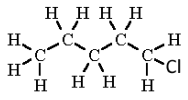
vi. X → Y *addition*

vii. E + Y → *Condensation (esterification)*

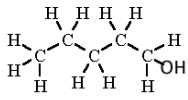
A = *pentane*



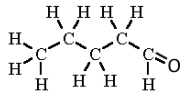
B = *1-chloropentane*



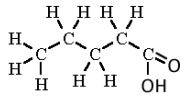
Z = *1-pentanol or pentan-1-ol*



D = *pentanal*

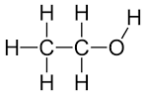


E = *pentanoic acid*

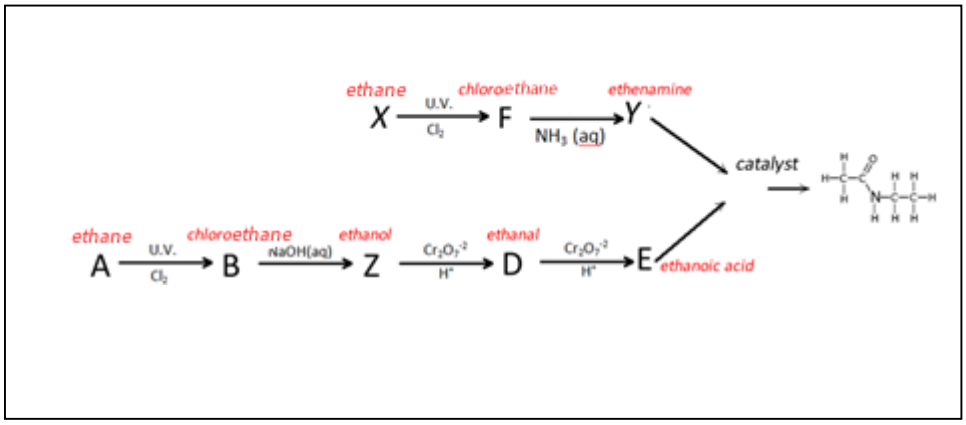


X= *ethene*

Y= *ethanol*



c) Consider the reaction pathways shown below.
identify all the compounds shown.



2) A weighed sample of methyl palmitate, $C_{17}H_{34}O_2$, was burnt in excess oxygen in a bomb calorimeter. The experimental results are shown in the following table.

mass of methyl palmitate	4.56 g
temperature rise	2.36 °C
calorimeter constant (calibration factor)	42.4 kJ $°C^{-1}$
$M(C_{17}H_{34}O_2)$	270.0 g mol^{-1}

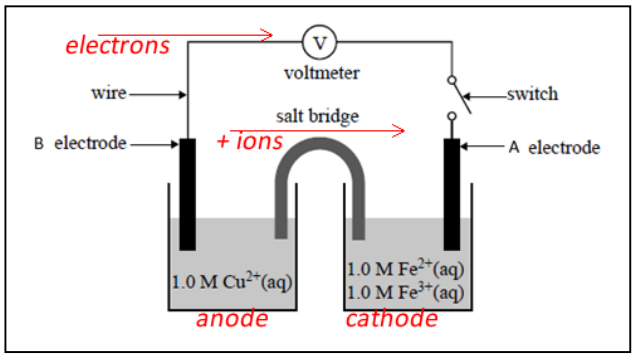
a) Use the data provided to calculate the molar enthalpy of combustion of the methyl palmitate

Step 1 find the mol of methyl palmitate
=> 4.56 / 270.0 = 0.0169
Step 2 find the energy released
=> E = 2.36 X 42.4 = 100.1 KJ
Step 3 find the molar enthalpy of combustion
=> 100.1/ 0.0169 = 5920 kJ/mol

b) Write a balanced **thermochemical** equation for the combustion reaction.

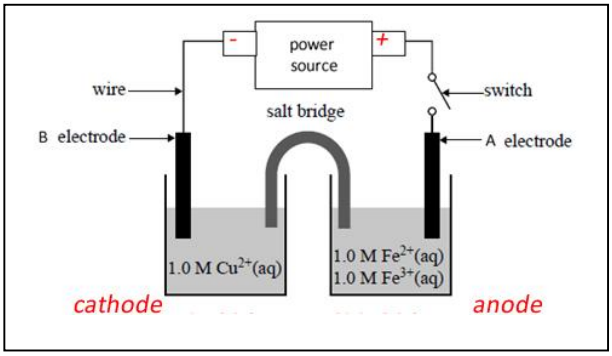
$2C_{17}H_{34}O_2(s) + 49O_2(g) \rightarrow 34CO_2(g) + 34H_2O(g)$ $\Delta H = -11841$ kJ/mol

3) The switch in the galvanic cell on the right may be closed to allow a current to flow through the circuit.



a) Which of the electrodes can be made of carbon? *A*
b) Indicate on the diagram the direction of electron flow.
c) Indicate the direction of positive ion flow.
d) What is the predicted cell voltage measured at the voltmeter when the switch is closed?
0.43 V
e) Indicate the anode and cathode.
f) Write the overall reaction taking place in the cell when the switch is closed?

$2Fe^{3+}(aq) + Cu(s) \rightarrow 2Fe^{2+} + Cu^{2+}(aq)$



g) The galvanic cell is to be recharged. It is connected to a power source and the switch closed. Indicate on the diagram

i. The polarity of the electrodes.
ii. The cathode and anode
iii. The half-cell reactions taking place
oxidation *$Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + e$*
reduction *$Cu^{2+}(aq) + 2e \rightarrow Cu(s)$*