Rings, Polymers & Analysis - Jan 2013

1a) Why is pyruvic acid soluble in water? (2)
-Hydrogen Bonding
- Suitable Diagram
-Explain how O is more electronegative than H etc.
-draw hydrogen bonds (OH to O in water, and c=O to H in water)

2) Nitration of methylbenzoate mechanism, and show h2so4 acts as a catalyst. (5).

Diagram of Nitration of Benzene. All relevant dipole etc.
$H_2SO_4 + HNO_3$ -------- $HSO_4 + NO_2 + H_2O$
$HSO_4^- + H^+$ -------- H_2SO_4

What type of mechanism is this? (1)

Electrophilic substitution

3) Nucleophilic addition, NABH4, reaction for pyruvic acid. (4)

Dipoles shown on O and C in C=O bond.

Curly arrow from Hydride ion to partially Positive Carbon
Curly arrow from = bond to oxygen
Correctly labeled negatively charged intermediate
Curly arrow from O- to h20 molecule then arrow from O-H bond to Oxygen forming an -OH ion

4) Distinguishing between compound A and pyruvic acid. (3)
Tollens Reagent.
Compound A has an aldehyde group, gets oxidised to a carboxylic acid. Silver Precipitate formed.
Redox reaction - aldehyde is oxidised, silver reduced
(Equation, Can't remember structure of Compound A). < You don't need to show equation + i think this was only 2 marks and secondly you could have written : $Ag^+ + e^- > Ag$ therefore silver solid formed. Ag reduced and compound A oxidised. get it? good.

Full oxidation reaction Propan 1 2 diol (2)

$CH_2OHCHOHCH_3 + 3[O]$ ------- $COOHCOCH_3 + 2H_2O$

Disappearance of peaks in d20 state three and explain why! (2)
-NH -OH -SH only specific to OH, NH and SH peaks
H2 isotope in D2O replaces the H1 on the -NH -OH -SH H2 has even number of nucleons so no residual spin, thus, no peak produced. (D2O doesn't absorb the radiation)
Didn't you have to put the -SH peak disappeared too?I THINK SO YES

(4)

Reagents for Reaction 1:

Sn catalyst & concentrated hydrochloric acid/H2SO4

Reagents/conditions for Reaction HCL & NaNO2 under 10C

Reagents/conditions for reaction 4:

Aqueous NaOH(aq) / Heat under reflux

Explain N,N-dimethylphenylamine's greater reactivity compared to benzene. (2 + QWC)

- Nitrogen has a lone pair that is partially delocalised into the delocalised ring of pi electrons. This means that it can polarise electrophiles more easily than benzene because there is an increase in electron density of the benzene ring
This activates it's ring.
Benzene has a spread out pi electron density, which does not allow a electrophile to be attracted

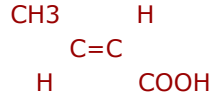
Mass Spec to gain molecular formula?(2)

empirical formula was C2H30 = molecular mass of 43
Molecular ion peak was 86
therefore Molecular formula was x2 to give C4H602

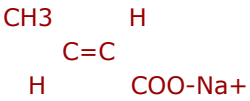
Compound B C D and polymer E question (4)

PLEASE SMEONE ANSWER_ do we get ECF marks if the double bond is shown but the strucutre is not drawnli

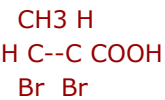
Compound B



Compound C:



Compound D:



Repeat Unit of Polymer E:

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 ----C----C------
     H     COOH
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Draw the optical isomer of the molecule with CH(COOH)___?(1).

Name the alcohol (1)
2-methyl propan-1-ol

Name of reaction when PAPA john's degrades (1).
Hydrolysis (didnt mention anything about acid hydrolysis, it just said it degrades on its own) They will probably ignore the acid part and credit hydrolysis. :)

no because it made a dicarboxylic acid if it was base hydrolysis this would make a carboxylate salt so you would have mention acid :) Yes, but it wasn't talking about using reagents, it just wanted the name of the breakdown, so, hydrolysis.

Circle repeat unit of PAPA (1).

Correctly circled / boxed unit, Cannot remember what it was!
I thought it was CO-(CH2)7-CO-O

Outline how the IR spectrum helps to identify the COOH bond in a molecule.(PAPA degradation) (2)

peak at 2500-3300 cm-1 very broad

What makes it an alpha amino acid?(1)

Both Carboxyl and Amino groups are attached to the same Carbon

Zwitterion (1)
COO- group and an NH3+ group

Protonated amino acid (1)

-COOH group and an NH3+ group

Polytide two repeat units (2?)

no need of brackets(check mark scheme of previous exams)

number of carbon enviroments? (2)

4
5

NMR peak area splitting and shift table (5)
MOLECULE : CH3-S-CH2-CH2-CH(NH2)-COOH

-COO**H** proton - singlet - chemical shift anywhere in the range 11-12ppm - RELATIVE AREA 1

-**H**CCOOH - triplet - chemical shift anywhere in the range 2-3ppm - RELATIVE AREA 1
-S-CH2-C**H2 -** quartet - chemical shift anywhere between 1 and 2ppm - RELATIVE AREA 2

think there was a HC-N group

Were there any more? :o - I remember 3 were done for us, that may have been the C**H3**-S (singlet - RELATIVE AREA 3), the -S-C**H2** (TRIPLET - RELATIVE AREA 2) and the N**H2** (SINGLET, RELATIVE AREA 2)

Mixed anhydrides two acids and ester structures (3)

Ethanoic acid/ carboxylic acid of whatever the other acid used to make the acid anhydride was - and then the ester of the other carboxylic acid with alcohol G (2-methyl-propan-1-ol)

Define retention time (1)
The time taken for a component to travel from the column inlet to the detector

Limitations of GC (1)
Some molecules have extremely similar/identical retention times.

Polyester 1 repeat unit of benzene 1 3 diol and HOOC(CH2)7COOH I think. (3)

-CO-(CH2)7-CO-O-BENZENE RING-O-

e^i*pi + 1 =15