DNS

Daya Nidhan and Singh

A Level Chemistry Level A

H432/03 Unified chemistry (Chemistry. Together. Strong)

Wednesday 2022 – Morning (or Afternoon)

Time allowed: 1 hour 30 minutes (or more if you want)

09031973 51

You might have:
- the Data Sheet for Chemistry A (sent with general stationery)

You may use:
- None of it

D131123

Name First										
Last name										
Landline number						Phone number				

INSTRUCTIONS
- Use ink. You may use an HB pencil for graphs and diagrams (or if you want to pull a John Wick (not legal advice)).
- Complete the boxes above with your name, phone number and landline number (call me).
- Answer **all** the questions (if you want/can).
- Write your answer to each question. If additional space is required, it's not my problem.
- Do **not** write in the barcodes (write over them you coot).

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]** but are more or less made up and may not reflect difficulty.
- Quality of extended responses will not be assessed and hence you won't see an asterisk (*) since I'm a dumb twit who can't get the full 6 marks.
- This document consisted of **16** pages, before I, y'know, changed the whole thing.

[031/2022/77] DC
(NH_3/CAT)131175/33

Turn over (I'm not gonna do it for you)

Answer **some of** the questions.

1 This question refers to The structure of various covalent ions and compounds.

(a) Draw the molecular structure of the molecules and ions below using arrows to indicate dative bonds and charges on the relevant bonding atoms.

(i) Nitrogen Dioxide (NO_2^-)

[1]

(ii) Azide (N_3^-)

[1]

(iii) Carbon Monoxide (CO)

[1]

(iv) Peroxide (O_2^{2-})

[1]

(v) Sulfate (SO_4^{2-})

[2]

(vi) Carbonate (CO_3^{2-})

[2]

(vii) Given that it is a mixture of covalently bonded anions, atoms and cations, Nitrate (NO_3^-)

[2]

(viii) 3 potential isomers of Nitrous oxide (N_2O)

[3]

(b) Explain why, regardless of structure, dinitrogen oxide (N_2O_2) will always have 5 bonds total.

.....

.....

.....

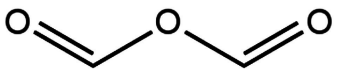
..... **[2]**

(c) Draw 16 possible structures for dinitrogen oxide (N_2O_2), drawing dative bonds with an arrow.

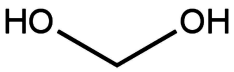
[4]

2 This question looks at Enthalpy changes of combustion.

(a) The structure of formic anhydride and methanediol are shown below:



Formic Anhydride



Methanediol

(i) Write an equation for the complete combustion of formic anhydride

..... **[2]**

(ii) Write an equation for the complete combustion of methanediol.

..... **[2]**

(b) The theoretical enthalpy change of combustion of methanediol is 517kJmol^{-1}.
Calculate the enthalpy change of combustion ($\Delta_c H°$) of formic anhydride.

Explain your reasoning.

$\Delta_c H°$ = ...kJmol^{-1}

.....

.....

.....

.....

[5]

(c) Give 2 reasons why the predicted value in part **(b)** may not be accurate.

.....

.....

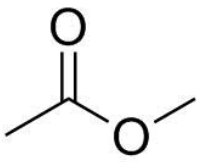
.....

.....

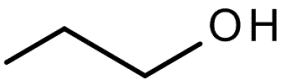
[2]

3 This question is about the reactions and properties of organic compounds

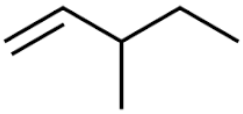
Below are the structures of some organic compounds



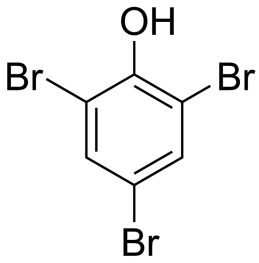
A



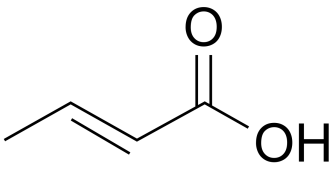
B



C

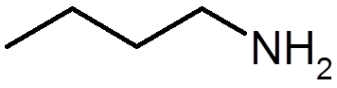


D



E

F



G

(a) Answer the below questions

(i) Which of these will react with acidified potassium dichromate?

..... **[1]**

(ii) Which of these display stereoisomerism?

..... **[1]**

(iii) Draw an alicyclic structural isomer of **C**.

..... **[1]**

(iv) Which of these will react with concentrated HCl.

..... **[1]**

(v) Which of these can polymerise?

..... **[1]**

(vi) Which of these do not have a 109.5° bond angle?

..... **[1]**

(vii) How many pairs of these molecules will react with each other?

..... **[1]**

(viii) Which of these have a molecular formula starting with $C_{2n}H_{2n-2}$

..... **[1]**

(b) Describe what ^{1}H NMR peaks you would expect compound **E**

.....

.....

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.....

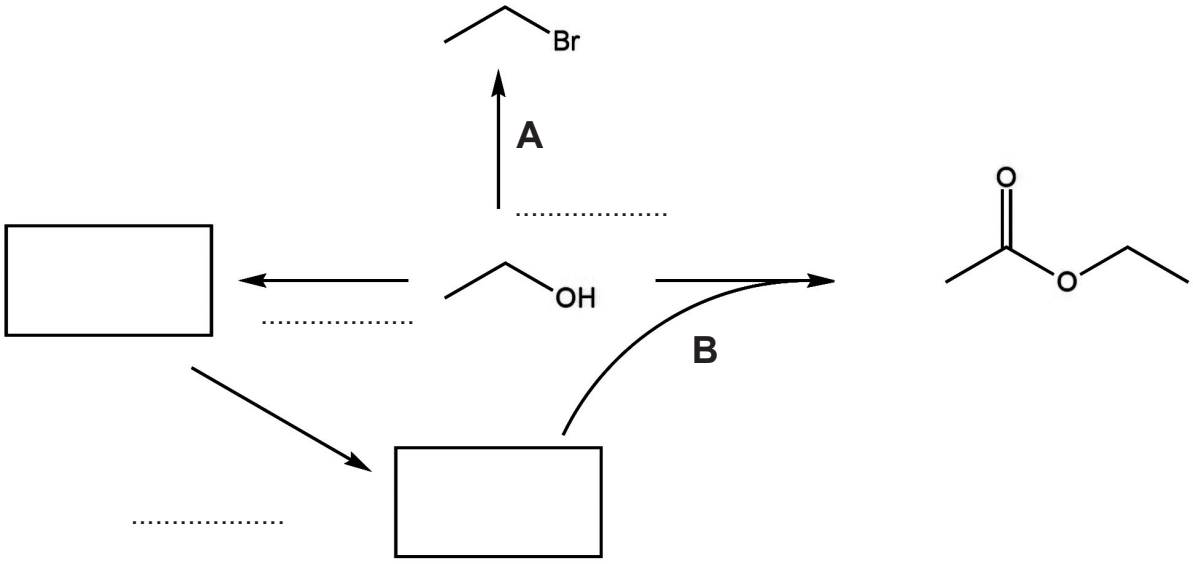
.....

.....

[4]

4 This question is about mechanisms of organic reactions.

Below is a synthesis route for the formation of bromoethane and ethylethanoate from ethanol



(a) Fill the gaps of the synthesis routes above, with all reagents and products, given that HCl is a biproduct of reaction **B**.

[5]

(b) Below are a few facts about reaction **A**:

- The rate equation is rate=k[CH_3CH_2OH]
- Before the reaction H_3O^+ is formed from H^+ ions
- The reaction has 3 steps
- The 2nd of the three steps is a slow step

Draw the mechanism for reaction **A**, including lone pairs and relevant dipoles.

[6]

(c) Below are a few facts about reaction **B**:

- There are 4 steps to this reaction.
- In the first step, the oxygen on the alcohol acts as a nucleophile, and in the last step, it acts like an electrophile.
- C=O is more polar than C-Cl

Draw the mechanism for reaction **B**, including lone pairs and relevant dipoles.

[7]

5 A student leaves another student clues for a made-up organic compound

The clues are listed below:

- The compound is a heptanoic acid with a molecular formula $C_{15}H_{22}O_3Cl_4$
- The compound does not display (E/Z) isomerism
- It has two branches, 3 carbons long
- These two branches contain 2 methyl groups and a C=C double bond. On them, each primary carbon has a chlorine bonded to it.
- Also on the branches is a tertiary alcohol that can dehydrate with an acid catalyst to form three different products (ignoring optical isomers).
- There is one more C=C double bond off these branches

(a) Name the compound below.

..... **[2]**

(b) Use the clues to find the student's compound

[8]

ADDITIONAL ANSWER SPACE (for additional answers)

If additional space is required, you could use the following lined page(s). The question number(s) must be clearly shown in the margin(s); or not (I ain't marking this).

DNS

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