

Sign Name Kay Print Name _____
 (2 pt each name above print & sign puntative points) (100 pts, 7 pages, make sure you have all pages)

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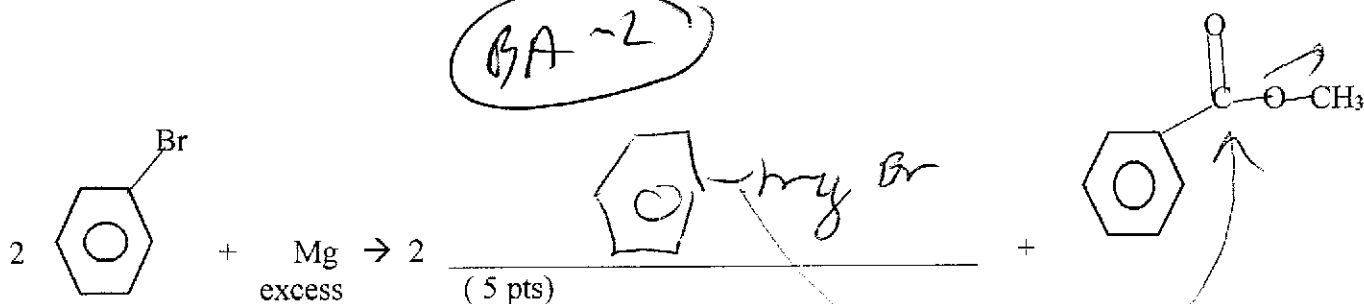
Please READ and FOLLOW directions. (ex: don't give me 5 structures if I only ask for one or you will lose points on this exam by **RUNNING OUT OF TIME**) R=alkyl, not hydrogen on all parts of this exam.

Grignard Reaction Lab (38 pts)

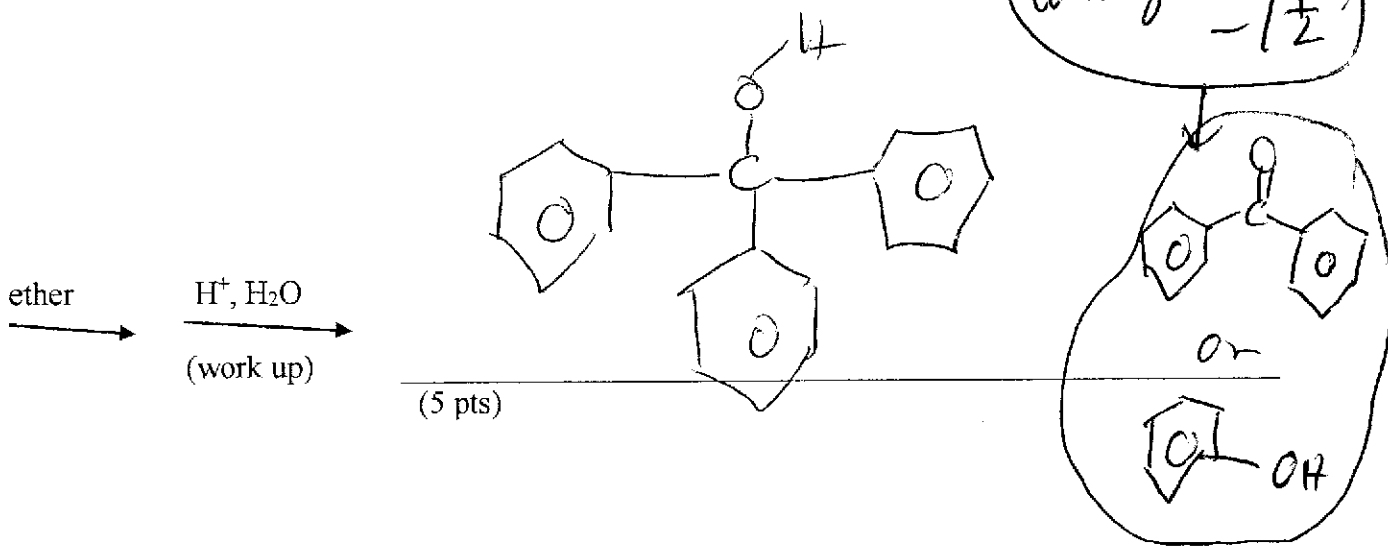
1. a. Complete the following reaction.

gave Rmg - 1/2

BA - 2



attempt - 1/2



b. Calculate the theoretical yield of the triphenyl methanol if you start with 0.357 grams of bromobenzene, assuming that the limiting reagent is the bromobenzene. (Formula mass of bromobenzene = 157.01 g/mol) (formula mass of triphenylmethanol = 260.35 g/mol) (If you came without a calculator, if you set up this problem, you will get the majority of the points.) (8 pts)

$$\begin{array}{ccccccc}
 \text{0.357 g} & \times & \frac{\text{1 mol}}{157.01 \text{ g}} & \times & \frac{\text{1 mol}}{2 \text{ mol}} & \times & \frac{\text{260.35 g}}{\text{1 mol}} \\
 \text{bromobenzene} & & \text{bromobenzene} & & \text{bromobenzene} & & \text{triphenyl methanol} \\
 & & & & & & \text{product}
 \end{array}$$

= 0.296 g triphenyl methanol

missing
step 2 each

upside
down 1

attempt
-4 pt

2. a. What happens if you do not dry your glassware in the oven in the Grignard reaction? (5 pts)

no reaction - H₂O on glassware quenches Rxn



attempt -2 pt

b. Show the potential side reaction result of undried glassware. Write out the side reaction in full showing structural formula of the entire reaction. (10 pts)

BA -7

attempt -5 pt

gave peroxide -2

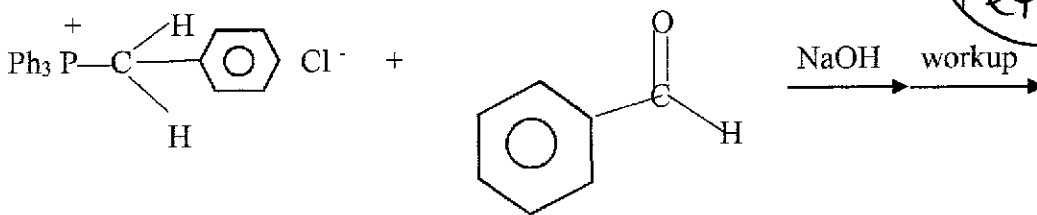
Why -1

3. In general during workup for almost all organic reactions why do you add sodium sulfate to your organic solution containing your product BEFORE rotovaporating away the organic solvent. (5 pts)

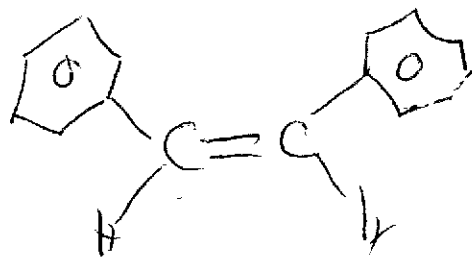
Na₂SO₄ removes water from organic solvent, H₂O has higher BP than most organic solvents & will stay ~~on~~ with product, you will get wet-messy product which you will have to heat to 100° to remove the H₂O, may get decomposition.

Wittig Reaction / Horner Wadsworth Emmons Reaction (28 pts)

1. a. Complete the Wittig reaction.



BA -3 left off



Steneo -1

BA -4 pt

(major product)

(6 pts)

b. Which reaction, (Wittig) or (Horner Wadsworth Emmons) gives the cis product? (6 pts)

- c. To do work up of the Wittig reaction you do an extraction with CH_2Cl_2 , (density water = 1.0 g/mL, density $\text{CH}_2\text{Cl}_2 = 1.320 \text{ g/mL}$). In your separatory funnel, what reagent is in the top layer? Which reagent is in the bottom layer?

[NaOH, unreacted benzaldehyde, product-stilbene, water (in NaOH solution), CH_2Cl_2]

Chemicals in the Top Layer: (8 pts)

H_2O , NaOH

(-1pt) (-1pt)

(GA - 5 pt)

-3pt top & bottom reversed

Chemicals in the Bottom Layer: (8 pts)

CH_2Cl_2 , unreacted benzaldehyde

product stilbene

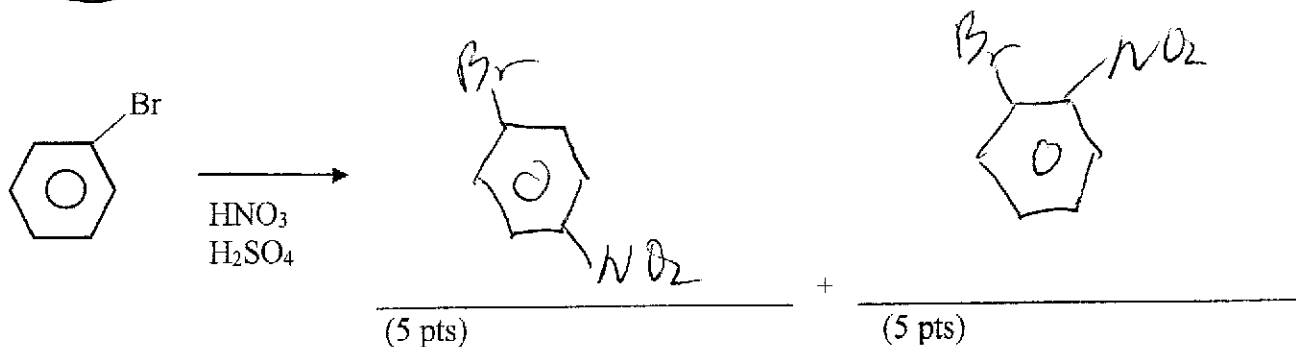
(1pt)

(1pt)

Electrophilic Aromatic Substitution / Nitration of Bromobenzene (34 pts)

1. a. Give the Electrophilic Substitution Reaction (give the expected 2 products)

(GA - 7)
gave di nitro
drew - 2 ±
gave meta - 2 ±



b. Why do you get more of the para product than the ortho product? Explain the statistical and other effect. (6 pts)

ortho has more statistical probability because there are 2 ortho positions to 1 para position. However because of steric hindrance, you get more para product,

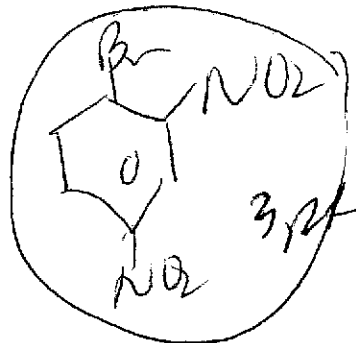
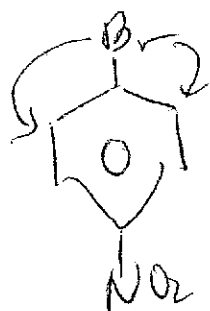
(3pt)

(3pt)

c. What is the other side reaction which goes at higher temperature? Show the structural formula of the side product or side products. Explain the regiochemistry of the side product. (6 pts)

dinitro

Br is more activating than NO₂

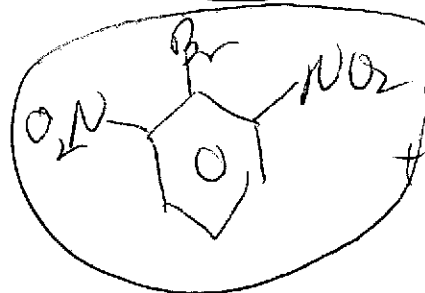


3pt

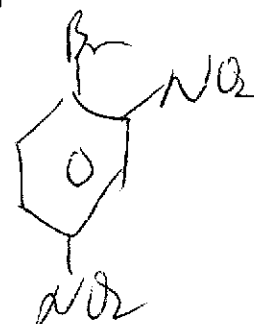
explain

(3pt)

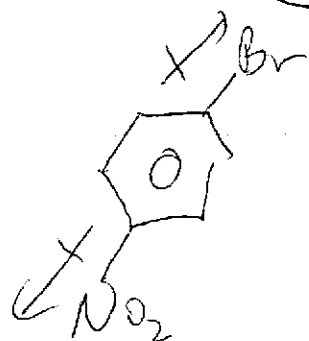
BA
-1/2



(3pt)



2. You do this reaction by mixing nitric acid and sulfuric acid which is dissolved in very polar solvent, water. During the course of the reaction you get a precipitate. What is the identity of the precipitate? Explain. (6 pts)



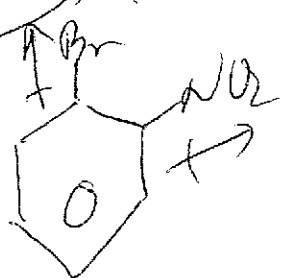
is less polar than all other products + precipitates out. It is less polar than bromobenzene

BA - 1/2 (3 pt)

3. When you use a column to purify your final product, which of your products

[~~p-bromonitrobenzene~~ or (o-bromonitrobenzene)] (circle one) will come out faster? Explain. (6 pts)

less polar



Para

is more polar than

BA - 1/2

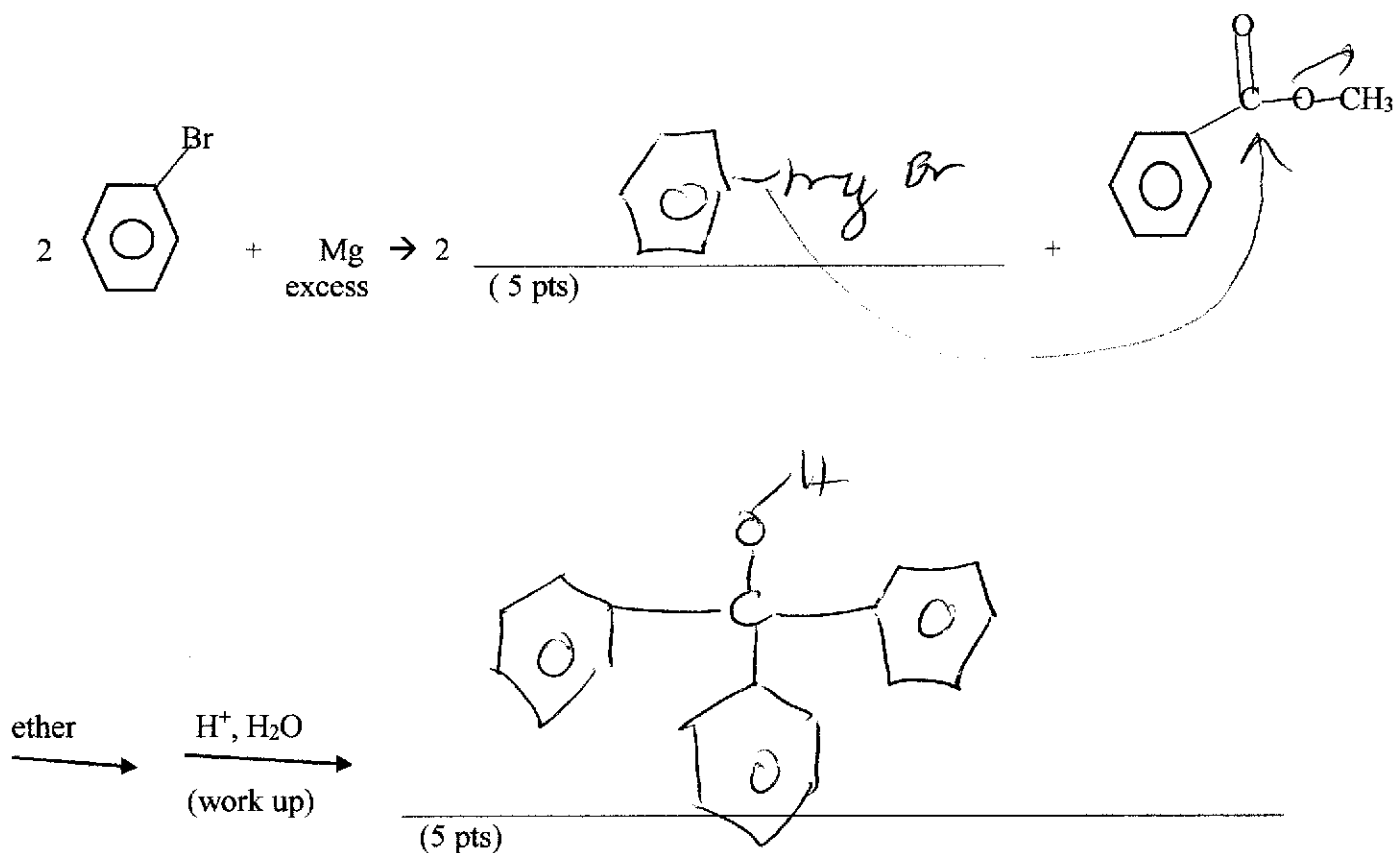
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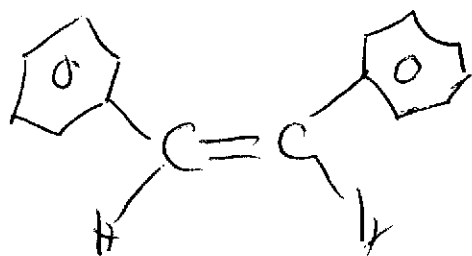
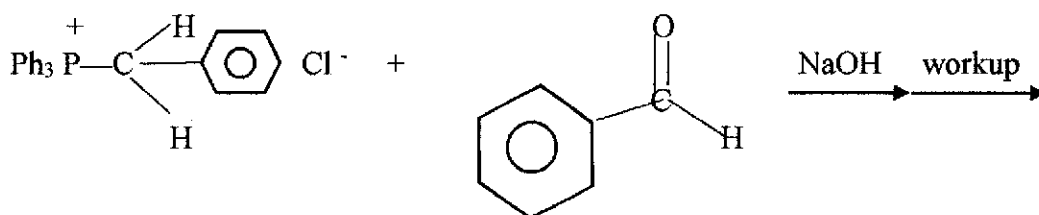


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(major product)

(6 pts)

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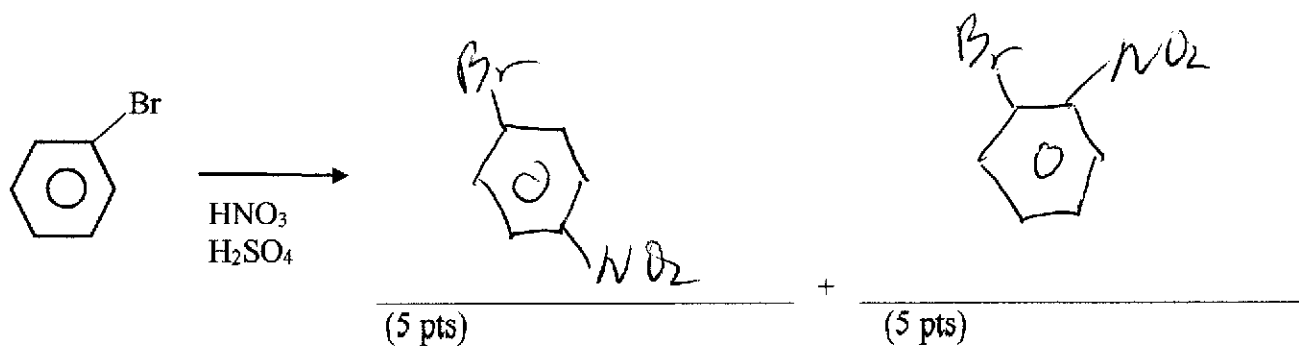
[NaOH, unreacted benzaldehyde, product-stilbene, water (in NaOH solution), CH_2Cl_2]

Chemicals in the Top Layer: (8 pts) H_2O , NaOH

Chemicals in the Bottom Layer: (8 pts) CH_2Cl_2 , unreacted benzaldehyde
product stilbene

Electrophilic Aromatic Substitution / Nitration of Bromobenzene (34 pts)

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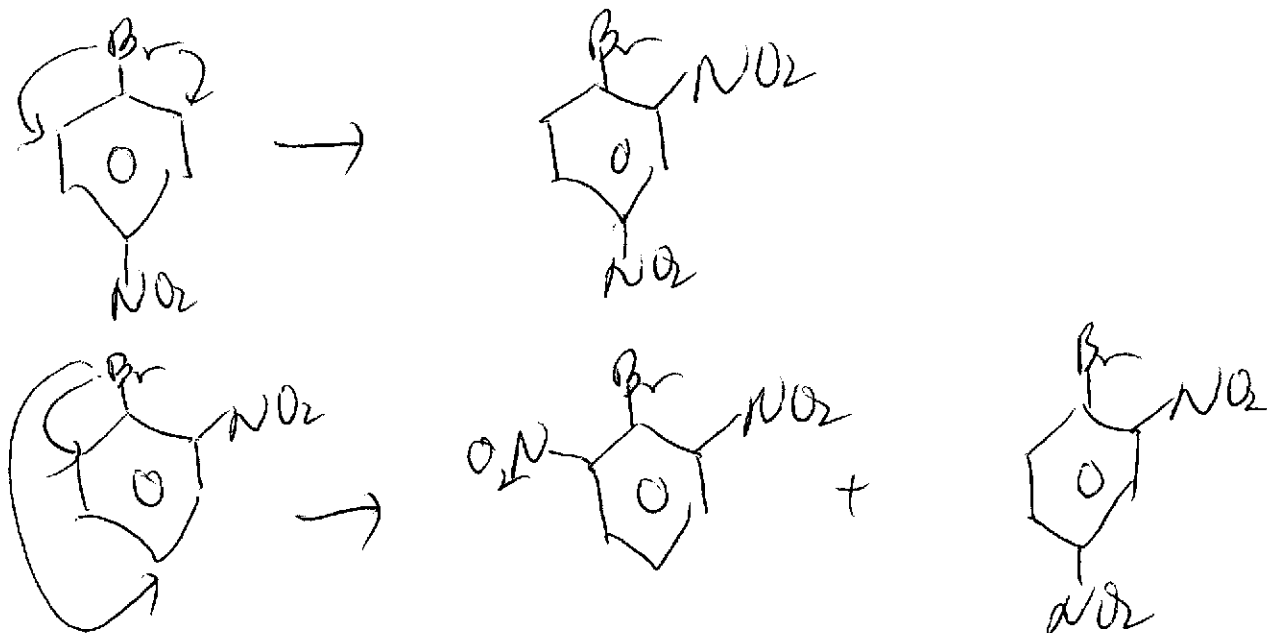


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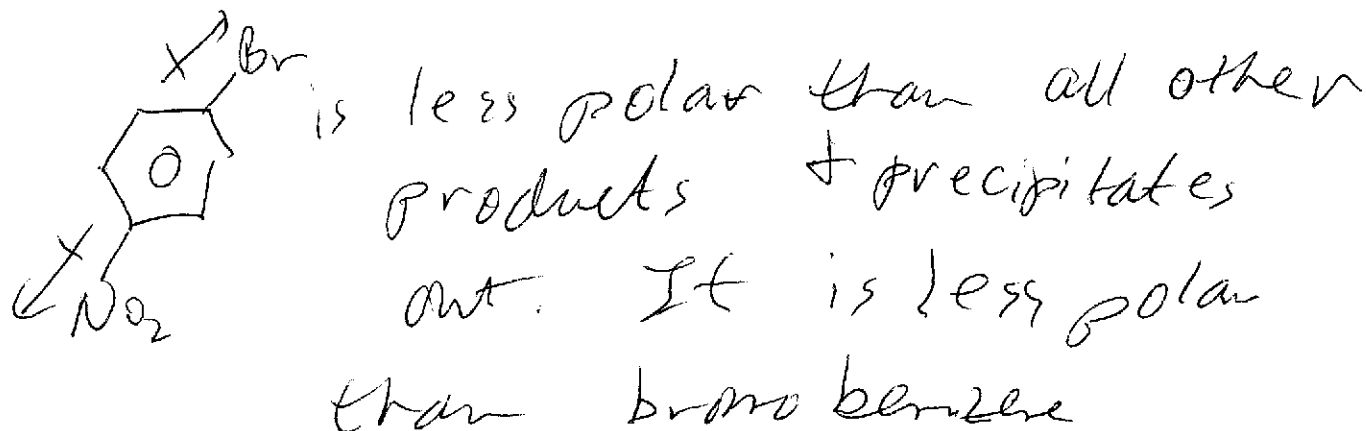
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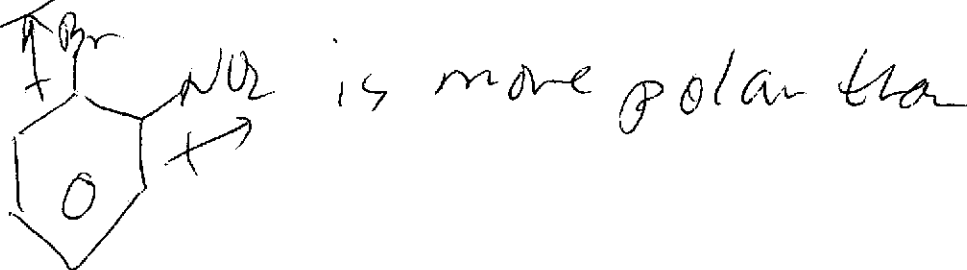


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Para