CHEM 3331 Xtreem Celebration of Learning™ #3

Dr. Minger July 30, 2019 Name_____

1) Circle your recitation section:

| 211 | Chance | 221 | Zhenhao |
|-----|----------------|-----|-----------------|
| 212 | Garrett | 222 | Eric |
| 213 | Dania | 223 | Wyatt |
| 214 | Will | 224 | Tianyi |
| 215 | Michael (3 pm) | 225 | Michael (12 pm) |

2) Sign the Honor Code statement:

I pledge on my honor as a CU student that I have neither given nor received unauthorized assistance on this exam.

General Instructions

There are 6 questions. Be sure you have them all. Read each question carefully so that you know exactly what is being asked. IF YOU DON'T UNDERSTAND, ASK!

| 1A | 2A | | | | | | | | | | | | ЗА | 4A | 5A | 6A | 7A | 8A |
|------------------------|---------------------|--------|--------------------|----------------------|------------------------|----------------------|----------------------|---------------------|---------------------|---------------------|---------------------|-----------------------|-----------------------|---------------------|-----------------------|--------------------|--------------------|----------------------|
| hydrogen 1 | = | | iā. | 45. | ā | s | 151 | ä | iā) | 16. | #151 | æ | 80. | 312 | 650 | 10 | ec , | helium 2 He |
| 1.0079 lithium 3 | beryllium 4 | | | | | | | | | | | | boron 5 | carbon 6 | nitrogen 7 | oxygen 8 | fluorine 9 | 4.0026 neon 10 |
| Li | Be | | | | | | | | | | | | B | Č | Ň | Ŏ | Ě | Ne |
| 6.941 sodium | 9.0122 | | | | | | | | | | | | 10.811 aluminium | 12.011 silicon | 14.007 phosphorus | 15.999 sulfur | 18.998 chlorine | 20.180 |
| 11 | magnesium 12 | | | | | | | | | | | | 13 | 14 | 15 | 16 | 17 | argon 18 |
| Na | Mg | | | | | | | | | | | | Al | Si | Р | S | CI | Ar |
| 22.990 potassium | 24.305 calcium | | scandium | titanium | vanadium | chromium | manganese | iron | cobalt | nickel | copper | zine | 26.982 gallium | 28.086 germanium | 30.974 arsenic | 32.065 selenium | 35.453 bromine | 39.948 krypton |
| 19 | 20 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| K | Ca | | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| 39.098 rubidium | 40.078 strontium | | 44.956 yttrium | 47.867 zirconium | 50.942 niobium | 51.996 molybdenum | 54,938 technetium | 55.845 ruthenium | 58.933 rhodium | 58,693 palladium | 63.546 silver | 65.39 cadmium | 69,723 Indium | 72.61 tin | 74.922 antimony | 78.96 tellurium | 79,904 lodine | 83.80 xenon |
| 37 | 38 | | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
| Rb | Sr 87.62 | | Y 88.906 | Zr 91.224 | Nb | Mo 95.94 | Tc | Ru | Rh | Pd 106.42 | Ag | Cd | In | Sn 118.71 | Sb 121.76 | Te | 126.90 | Xe 131.29 |
| caesium 55 | barium 56 | 57-70 | lutetium 71 | hafnium 72 | tantalum 73 | tungsten 74 | rhenium 75 | osmium 76 | iridium 77 | platinum 78 | gold 79 | mercury 80 | thallium 81 | lead 82 | bismuth 83 | polonium 84 | astatine 85 | radon 86 |
| Cs | Ba | * | Ľu | Ηf | Та | w | Re | Os | ĺr | Pt | Au | Hg | ŤΙ | Pb | Bi | Po | Åt | Rn |
| 132.91 | 137.33 | ^ | 174.97 | 178,49 | 180.95 | 183.84 | 186.21 | 190.23 | 192.22 | 195.08 | 196.97 | 200.59 | 204,38 | 207.2 | 208,98 | [209] | [210] | [222] |
| francium 87 | radium 88 | 89-102 | lawrencium 103 | rutherfordium 104 | dubnium 105 | seaborgium 106 | bohrium 107 | hassium 108 | meitnerium 109 | ununnilium 110 | unununium 111 | ununbium 112 | | ununquadium 114 | | | | |
| Fr | Ra | * * | Lr | Rf | Db | Sg | Bh | Hs | Mt | | Uuu | | | Uuq | | | | |
| [223] | [226] | | [262] | [261] | [262] | [266] | [264] | [269] | [268] | [271] | [272] | [277] | | [289] | | | | |
| | | | | | | | | | | | | | | | | | | |
| *Lanth | nanide | cariac | lanthanum 57 | cerium 58 | praseodymium 59 | neodymium 60 | promethium 61 | samarium 62 | europium 63 | gadofinium 64 | terbium 65 | dysprosium 66 | holmium 67 | erbium 68 | thulium 69 | ytterbium 70 | | |
| Laiiti | iamue | 301163 | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Но | Er | Tm | Yb | | |
| | | | 138.91 actinium | 140.12 thorium | 140.91 protactinium | 144.24 uranium | [145] neptunium | 150.36 plutonium | 151,96 americium | 157.25 curium | 158.93 berkelium | 162.50 californium | 164.93 einsteinium | 167,26 fermium | 168.93 mendelevium | 173.04 nobelium | | |
| * * Acti | inide se | eries | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | | |
| | | | Ac [227] | Th 232.04 | Pa 231.04 | 238.03 | Np | Pu | Am [243] | Cm | Bk [247] | Cf [251] | Es | Fm | Md | No [259] | | |

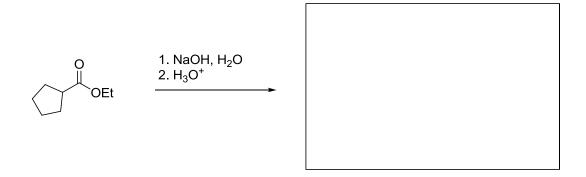
For questions 1, 2, and 3, we will only grade what is written IN the boxes.

1) Complete this short synthesis of the amino acid isoleucine by writing the missing reagents needed for each step in the boxes. (4 pts)

2) Dicarbonyl compounds can undergo intramolecular reactions. Draw the major organic product that would form under the following conditions. (4 pts)

3) The neurotransmitter serotonin can be converted to a hormone called melatonin in a two step sequence. Complete this short synthesis of melatonin by writing the missing reagents for each step in the boxes. (4 pts)

4) Draw the major organic product of this reaction in the box provided. Then draw a mechanism to rationalize its formation. Show all curved arrows, lone pair electrons and nonzero formal charges in your mechanism for full credit. (10 pts)



When the two compounds shown are combined and refluxed in aqueous sodium hydroxide, a Robinson annulation occurs. Draw the product of the Robinson annulation. In your drawing of the product, write the labels (1, 2, etc.) from the starting materials on the appropriate carbon atoms for full credit. **Only the structure in the box will be graded.** (10 pts)

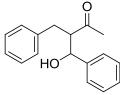
Design a multistep synthesis of each of the following two target molecules, incorporating either an acetoacetic ester synthesis or a malonic ester synthesis as part of your sequence of steps. This means that each synthesis will start with either ethyl acetoacetate or diethyl malonate (structures given). You do not have to use the same starting material in both syntheses. Show the reagents for each step and the product of each step. Do not draw any mechanisms (curved arrows). Write your final answers in the boxes provided. **Nothing outside the boxes will be graded.** (18 pts)

Target 1: (Target 2 is on the next page)

$$H_2N$$



Target 2:





Extra credit. Extremely famous pigeon chemist Professor Burblecoo prefers doing reactions and syntheses that involve carboxylic acids (RCOOH; the pigeon likes the abbreviation and repeats it frequently) as well as reactions using organocuprates (the pigeon thinks these are organoCOOprates and mentions that to anyone who will listen). The professor tries to avoid decarboxylations (loss of COO).

Design a pigeon-friendly synthesis of 6-methyl-3-heptanone (a compound found in basil, melons, and potatoes) starting with oxirane, observing these conditions:

- At least one of your synthetic intermediates must be a carboxylic acid. (A synthetic intermediate is the product of a step in a multi-step synthesis.)
- You learned three reactions of organocuprates in lecture. You must use all three of these reactions in your synthesis. You do not have to use the same organocopper reagent each time.

Show the reagents needed for each step and the product of each step. Do not draw any mechanisms.

