

Running on Windows Pro/7 (I.Explorer 8&9, Firefox, GoogleChrome) and MacOS.X10.5+ (I.Explorer, Firefox, Safari)

Time remaining: 59:53

EChemTest - Organic Chemistry 3

Welcome ...

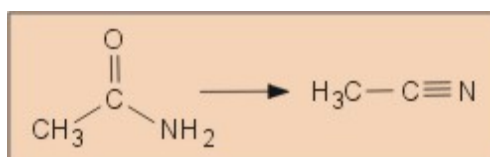
1 of 30

Use the marker to select from the following structures the **one** with the IUPAC-name **2,5-dibromo-4-ethylnon-4-ene**.



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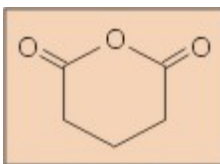
How does the hybridisation of the carbonyl carbon change in the following reaction?



- ☐ sp^2 to sp^3
- ☐ sp^3 to sp^2
- ☐ sp^2 to sp
- ☐ sp to sp^3
- ☐ no changes

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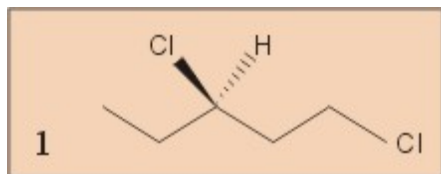
Which **one** of the following functional groups is present in the structure shown?



- ☐ lactone
- ☐ carbonate
- ☐ anhydride
- ☐ ketoester

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Use the marker to select which **one** of the structures **A**, **B**, **C** or **D** has a different configuration from structure **1**.



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Which **one** of the following series contains only nucleophiles?

- ☐ NH_3 ; H_2O ; CN^- ; I^-
- ☐ NH_3 ; H_2O ; BF_4^- ; Br^-
- ☐ NH_3 ; H_2O ; I^- ; BH_3
- ☐ AlCl_3 ; Me_3O^+ ; NO_2^+ ; BF_3

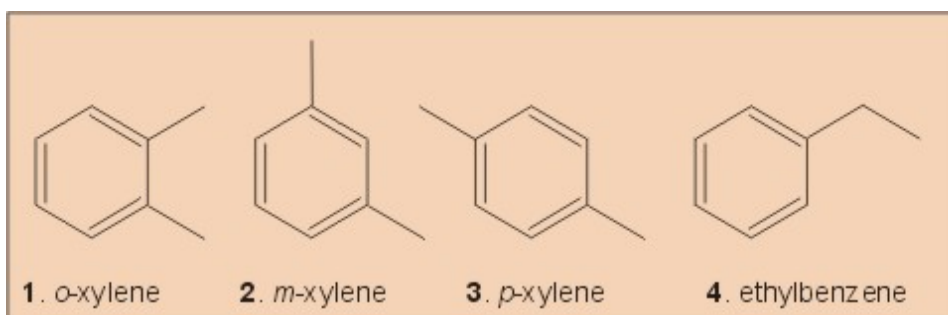
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Which of the following solvents easily forms dangerous peroxides when exposed to air and light for longer periods of time?

- ☐ Ethanol
 - ☐ Diethyl ether
 - ☐ Dimethylformamide (DMF)
 - ☐ t-Butyl methyl ether (MTBE)
-

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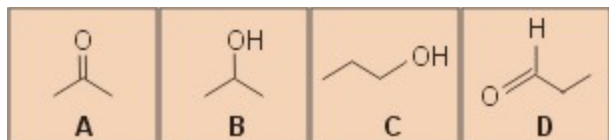
Which **one** of the following aromatic compounds has five peaks in its C-H decoupled ^{13}C NMR spectrum?



- ☐ *o*-xylene (**1**)
 - ☐ *m*-xylene (**2**)
 - ☐ *p*-xylene (**3**)
 - ☐ ethylbenzene (**4**)
-

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Click the selected molecule (A, B, C or D) which would be the major product in the following reaction and drag it after the reaction arrow.



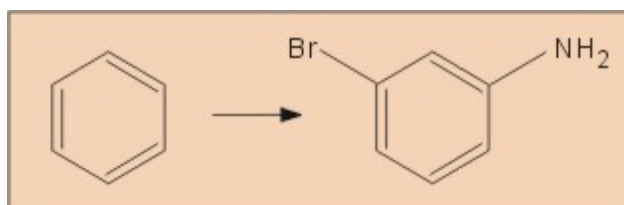
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Which **one** of the following statements concerning **E1** elimination reactions is correct ?

- ☐ E1 elimination reactions proceed only in the presence of a strong base.
- ☐ E1 reactions will generally go faster in hexane than in water as a solvent.
- ☐ The E1 mechanism is a two-step mechanism with a positively charged intermediate.
- ☐ The stereochemistry of E1 elimination reactions follows preferentially an *anti*-elimination pathway.

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Select from the following sets of reagents and conditions the **one** which most likely will lead to the product shown in the reaction scheme.



- ☐ 1. HNO₃/H₂SO₄ ; 2. Fe/HCl ; 3. Br₂/FeBr₃
- ☐ 1. HNO₃/H₂SO₄ ; 2. Br₂/FeBr₃ ; 3. NaNH₂
- ☐ 1. HNO₃/H₂SO₄ ; 2. Br₂/FeBr₃ ; 3. Fe/HCl
- ☐ 1. Br₂/FeBr₃ ; 2. HNO₃/H₂SO₄ ; 3. Fe/HCl

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Which **one** of the following statements concerning **Grignard** reactions is correct ?

- ☐ Acetone and acetaldehyde give the same secondary alcohol when treated

with excess $\text{C}_2\text{H}_5\text{MgBr}$ followed by $\text{H}^+/\text{H}_2\text{O}$.

- ☐ $\text{CH}_3\text{COOCH}_3$ and $\text{CH}_3\text{COOC}_6\text{H}_5$ give the same secondary alcohol when treated with excess $\text{C}_2\text{H}_5\text{MgBr}$ followed by $\text{H}^+/\text{H}_2\text{O}$.
- ☐ $\text{C}_2\text{H}_5\text{COOCH}_3$ and $\text{CH}_3\text{COOC}_2\text{H}_5$ give the same tertiary alcohol when treated with excess $\text{C}_2\text{H}_5\text{MgBr}$ followed by $\text{H}^+/\text{H}_2\text{O}$.
- ☐ $\text{CH}_3\text{COOCH}_3$ and $\text{CH}_3\text{COOC}_6\text{H}_5$ give the same tertiary alcohol when treated with excess $\text{C}_2\text{H}_5\text{MgBr}$ followed by $\text{H}^+/\text{H}_2\text{O}$.

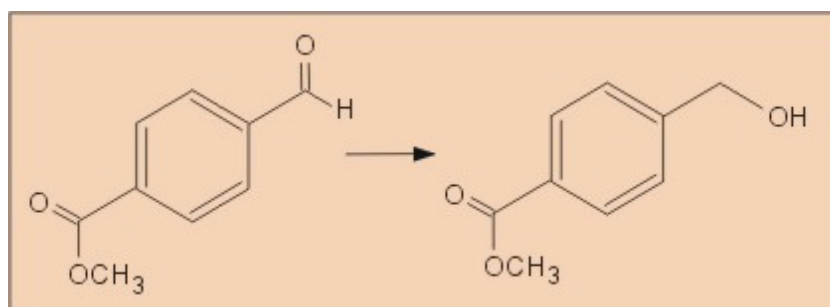
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Use the marker to select which **one** of the alkenes shown below gives ethanal and butan-2-one when subjected to ozonolysis.



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Which **one** of the following reagents is suitable for the transformation shown below?



- ☐ NaBH_4 in methanol
- ☐ LiAlH_4 in diethyl ether
- ☐ NaH in tetrahydrofuran
- ☐ H_2 , Pd-C in methanol

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Which of the following anions is the weakest base ?

- ☐ $\text{C}_2\text{H}_5\text{O}^-$
 - ☐ $\text{C}_6\text{H}_5\text{SO}_3^-$
 - ☐ $\text{C}_6\text{H}_5\text{O}^-$
 - ☐ $\text{C}_6\text{H}_5\text{CO}_2^-$
-

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Use the marker to select which **one** of the following peroxides is most easily formed from the corresponding hydrocarbon by auto-oxidation via a radical reaction.



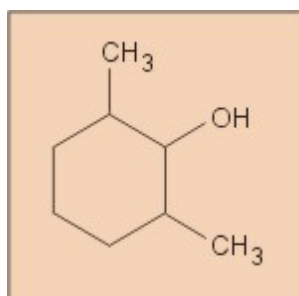
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Use the marker to select which **one** of the following structures would be predicted to be aromatic according to Hückels rule.



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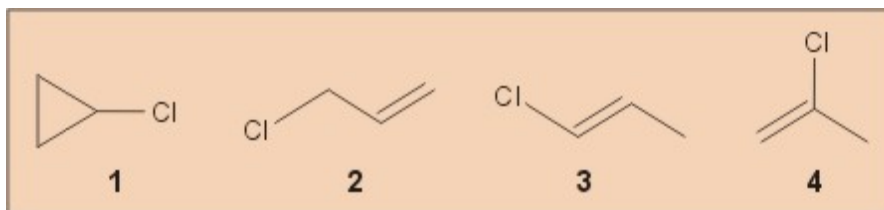
How many stereoisomers (configurational isomers) with the constitution shown below are possible?



- ☐ 4 (1 pair of enantiomers plus 2 meso compounds)
☐ 8 (4 pairs of enantiomers)
☐ 3 (1 pair of enantiomers plus 1 meso compound)
☐ 6 (2 pairs of enantiomers plus 2 meso compounds)

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Match the compounds **1-4** with the selected spectral characteristics.



Look up spectroscopy data:

Approximate ^1H signal ranges		δ (in ppm / TMS / CDCl_3)
H-C-SiR_3		0.0-0.1
H-C	(cyclopropyl)	0.3-0.5
H-C-C	(sp^3)	0.8-1.8
H-C-C=C	(olefinic)	1.7-2.6
H-C-C=C	(aromatic)	2.3-3.0
H-C-CO	(carbonyl)	2.0-3.5
H-C-O-	(alcohol, ether)	3.3-4.0
H-C-O-CO-		3.7-5.0
H-C-N-	(amine)	2.2-4.0
H-C-N-CO-	(amide)	2.9-4.3
H-C-X	(bromide, chloride)	2.7-4.0
H-C=C	(olefinic)	4.5-6.6
H-C=C-OR		4.0-4.9
C=CH-OR		6.4-7.4
H-C=C	(aromatic)	6.0-8.5 higher range for $\alpha\text{-H-Ar-CO-}$
	(in pyridines)	8.5 (H-2), 7.0 (H-3), 7.4 (H-4)
H-CO-	(aldehyde)	9.4-10
$-\text{CONH}_2$		5.0-6.5
$=\text{N-OH}, -\text{COOH}$		10-12

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Approximate ^{13}C signal ranges		δ (in ppm / TMS / CDCl_3)
-CH ₃	(in nonfunctional alkyl or alkene)	0 - 30 (20 - 30 in CH ₃ -CO-)
-CH ₂ -	(in nonfunctional alkyl or alkene)	20 - 45 (0 - 10 in cyclopropanes)
-CH-	(in nonfunctional alkyl or alkene)	30 - 60
-C-	(quaternary nonfunctional alkyl)	30 - 50
-O-CH ₃		50 - 60
-N-CH ₃		15 - 45
-CC-		75 - 95
-C=C-	(alkene)	100 - 150
-C=C-	(aromatic)	110 - 160
-CN		115 - 125
-CO-	(acids, esters, amides)	165 - 185
-CO-	(aldehydes, ketones)	190 - 220

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IR absorption ranges		cm^{-1} (s = strong, m = medium, w = weak)
alcohol		3400-3600 (m or s)
aldehyde	saturated	1725 (s)
	α,β -unsatd or aryl	1680-1700 (s)
alkane	CH ₃ , CH ₂ , CH	2800-3000 (m or w)
alkene	-CH=C, CH ₂ =CH	3000-3100 (m or w), 1620-1670 (m or w), 990 (s) and 910 (s) in monosubstd
amide	-CO-NH ₂	3200-3400 (m), 1650-1680 (s)
amine	NH ₂ , NH	3400-3500 (w or m); 3200-3400 (m) in amides
aromatic ring		3000-3100 (m or w), 1450-1600 (m or s), 730-770 (s) and 680-710 (s) in monosubstd
carboxylic acid		2400-3000 (w or m)
	alkyl-COOH	1720 (s)
	α,β -unsatd or aryl	1690 (s)
ether	aliphatic	1070-1150 (s)
ketone	saturated	1715 (s)
	α,β -unsatd or aryl	1670-1690 (s)
nitrile	-CN	2220-2260 (m or s)
nitro	alkyl-NO ₂	1550 (s), 1350 (s)
	aryl-NO ₂	1530 (s), 1350 (s)
oxime	-N=OH	3600 (m), 1640-1690 (w)
phenol	Ar-OH	3500-3600 (m) plus aromatic absorptions
sulfone	Ar-SO ₂ -Ar	1350 (s), 1160 (s)
sulfoxide	Ar-SO-Ar	1030 (s)

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IR: 990 cm^{-1} (strong) and 910 cm^{-1} . ^{13}C NMR: δ = 111.8 (singlet) and 131.7 (triplet). ^1H NMR: δ = 0.3 (4H, multiplet), and 3.0 (1H, multiplet). ^1H NMR: δ = 1.70 (3H), 5.85 (1H) and 6.05 (1H).

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Use the marker to select which **one** of the structures shown below represents the dimer which is formed from cyclopentadiene at room

temperature.



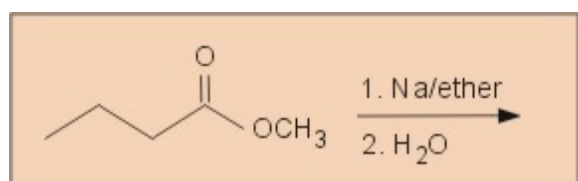
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Use the marker to select which **one** of the compounds shown below will give a deuterium-free main product on treatment with potassium tert.butoxide (KOBU^t) in HOBU^t .



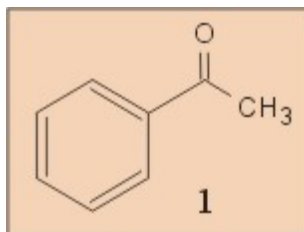
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Use the marker to select which **one** of the compounds shown below is the major product of the reaction of ester **1** with sodium metal followed by hydrolysis.



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Which products will arise from the **Baeyer-Villiger** oxidation of acetophenone (**1**) followed by hydrolysis?



- ☐ o-hydroxybenzoic acid (salicylic acid) and methanol
- ☐ a mixture of acetic and benzoic acid, phenol and methanol
- ☐ benzoic acid and methanol
- ☐ acetic acid and phenol

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Select from the following sets of reagents and conditions the **one** which will most likely lead to the product shown in the reaction scheme.



- ☐ 1. CH_3Li (2 eq) then $\text{H}^+/\text{H}_2\text{O}$
- ☐ 1. $(\text{CH}_3)_2\text{CuLi}$ (1 eq) then $\text{H}^+/\text{H}_2\text{O}$
- ☐ 1. $\text{C}_6\text{H}_5\text{OH}/\text{H}^+$; 2. CH_3MgBr (2 eq) then $\text{H}^+/\text{H}_2\text{O}$
- ☐ 1. CH_3MgBr (3 eq) then $\text{H}^+/\text{H}_2\text{O}$

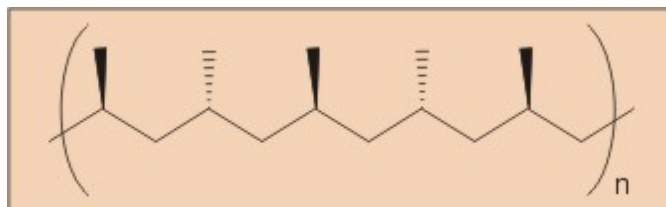
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Use the marker to select which **one** of the amino esters (1 mole) shown below reacts with 2 moles of acetic anhydride and gives no N_2 on treatment with HNO_2 .



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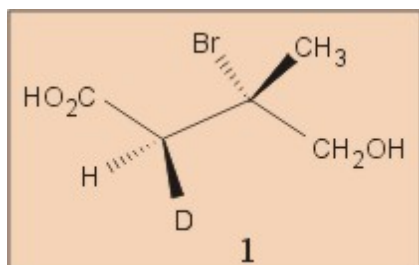
Which type of polymer is represented by the following structural formula?



- ☐ isotactic polypropylene
- ☐ isotactic polyethylene
- ☐ atactic polypropylene
- ☐ syndiotactic polypropylene

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Use the marker to select which **one** of the Fischer projections shown below correctly represents compound **1**.



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Use the marker to select which **one** of the stereoisomers of 1,2,3,4,5,6-hexahydroxycyclohexane shown below has the following spectroscopic properties in D₂O.

¹ H NMR: δ	¹³ C NMR: δ
3.88 (1H, t, J = 2.8 Hz)	71.1 (d)
3.46 (2H, t, J = 9.6 Hz)	72.2 (d)
3.36 (2H, dd, J = 2.8; 9.6 Hz)	72.4 (d)
3.10 (1H, t, J = 9.6 Hz)	74.3 (d)

Look up spectroscopy data:

Approximate ¹ H signal ranges		δ (in ppm / TMS / CDCl ₃)
H-C-SiR ₃		0.0-0.1
H-C	(cyclopropyl)	0.3-0.5
H-C-C	(sp ³)	0.8-1.8
H-C-C=C	(olefinic)	1.7-2.6
H-C-C=C	(aromatic)	2.3-3.0
H-C-CO	(carbonyl)	2.0-3.5
H-C-O-	(alcohol, ether)	3.3-4.0
H-C-O-CO-		3.7-5.0
H-C-N-	(amine)	2.2-4.0
H-C-N-CO-	(amide)	2.9-4.3
H-C-X	(bromide, chloride)	2.7-4.0
H-C=C	(olefinic)	4.5-6.6
H-C=C-OR		4.0-4.9
C=CH-OR		6.4-7.4
H-C=C	(aromatic)	6.0-8.5 higher range for α-H-Ar-CO-
	(in pyridines)	8.5 (H-2), 7.0 (H-3), 7.4 (H-4)
H-CO-	(aldehyde)	9.4-10
-CONH ₂		5.0-6.5
=N-OH, -COOH		10-12

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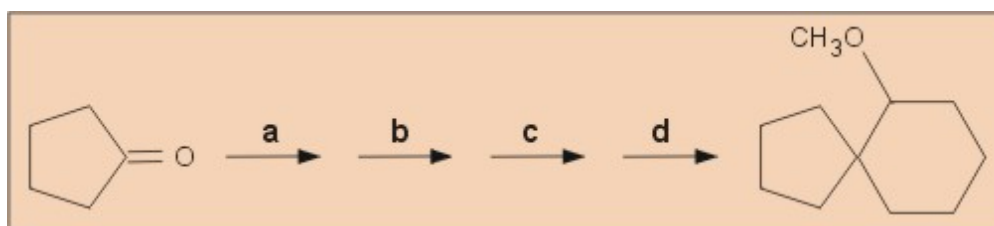
Approximate ¹³ C signal ranges		δ (in ppm / TMS / CDCl ₃)
-CH ₃	(in nonfunctional alkyl or alkene)	0 - 30 (20 - 30 in CH ₃ -CO-)
-CH ₂ -	(in nonfunctional alkyl or alkene)	20 - 45 (0 - 10 in cyclopropanes)
-CH-	(in nonfunctional alkyl or alkene)	30 - 60
-C-	(quaternary nonfunctional alkyl)	30 - 50
-O-CH ₃		50 - 60
-N-CH ₃		15 - 45
-CC-		75 - 95
-C=C-	(alkene)	100 - 150
-C=C-	(aromatic)	110 - 160
-CN		115 - 125
-CO-	(acids, esters, amides)	165 - 185
-CO-	(aldehydes, ketones)	190 - 220

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Choose from the select boxes the appropriate reagent for each step of the following synthetic sequence.

Reagent needed for step **a**: Reagent needed for step **b**: Reagent needed for step **c**: Reagent needed for step **d**:

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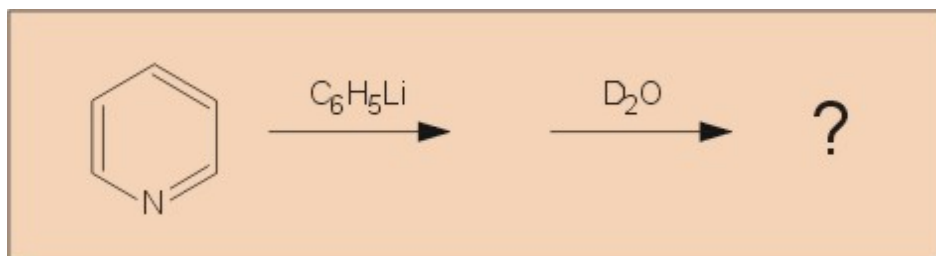
029n Use the marker to select the **one** of the five OH-groups of b-D-glucose which is easily substituted by OCH₃ on treatment with hydrochloric acid in methanol.



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Use the marker to select which one of the compounds shown below is predominantly formed in the reaction of pyridine with phenyl lithium and

subsequent addition of D₂O.



Submit

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