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THE OPEN UNIVERSITY OF SRI LANKA
B.Sc DEGREE PROGRAMME / STAND ALONE COURSE 2004 / 2005

LEVEL 4 - FINAL EXAMINATION

CHU 2221 / CHE 4221 - ORGANIC CHEMISTRY - PAPER I

432

Duration: 2 1/2 HOURS

Wednesday, 27th June 2007

10.00 a.m.-12.30 p.m.

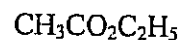
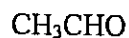
Attempt as many questions as possible.

Maximum marks allocated to this paper are 120. However a candidate who scores 100 marks or above will be awarded 100% and those scoring less will be awarded the score they make.

Write your answers in the space provided at each question.

1. Answer both parts.

(a) State whether each of the following compounds will form hydrogen bonds among themselves. (*Strike off the incorrect answer*).



Yes/No

Yes/No

Yes/No

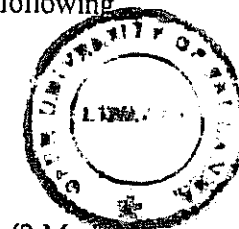
Yes/No

(2 Marks)

(b) State, which compound has the higher solubility in water in each of the following pairs of compounds.

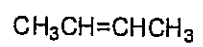
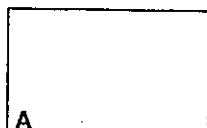
i. *o*-nitrophenol and *p*-nitrophenol

ii. propanol and propanal



(2 Marks)

2. Give the structures of A and B of the following reaction scheme.



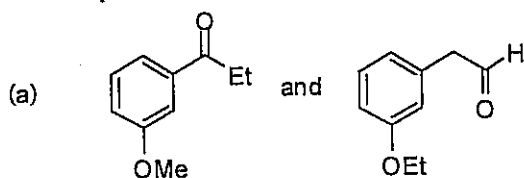
(4 Marks)

3. How would you explain the fact that 2-butene is more stable than 1-butene.

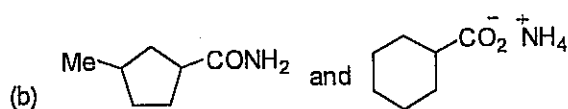


(4 Marks)

4. Give a chemical test to distinguish between the compounds in each of the following pairs of examples.



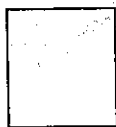
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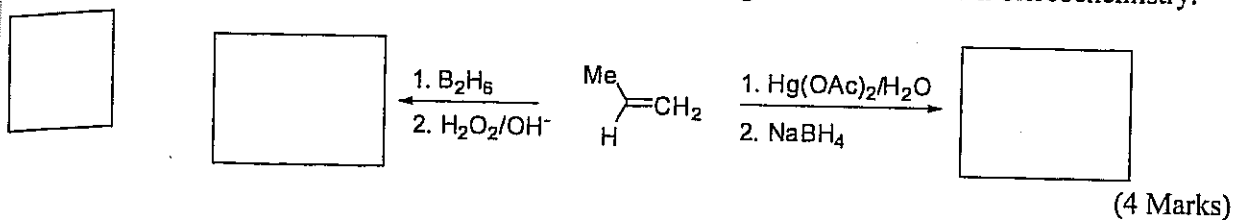
(4 Marks)

5. Giving the mechanism postulate the structure of the mono-halogenated product formed when 2-methyl propane is heated with a limited amount of Br₂ to a higher temperature.

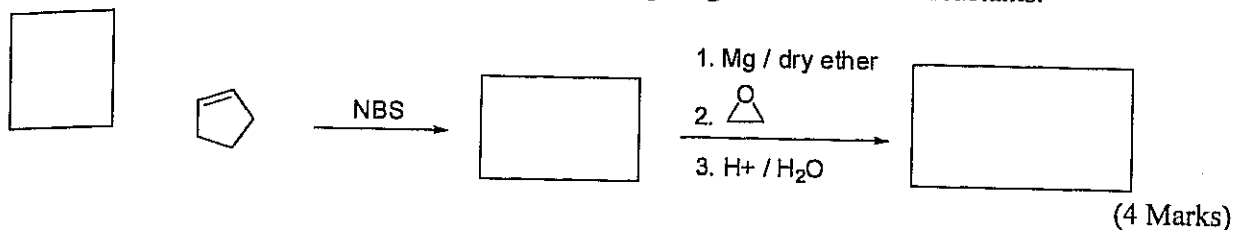


(4 Marks)

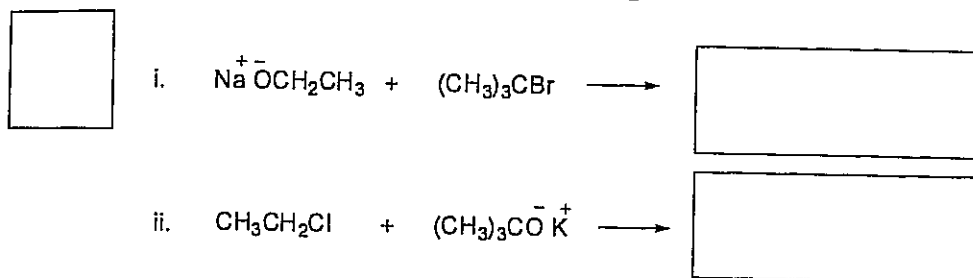
6. Give the structure of the products of the following reactions with their stereochemistry.



7. Complete the following reaction scheme giving structures of the reactants.

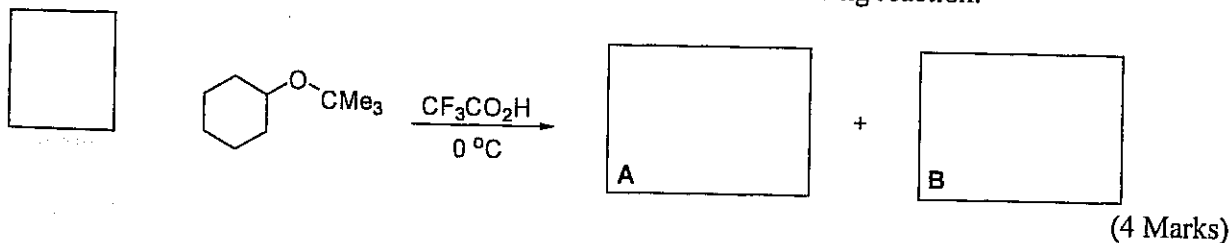


8. Give the major products of the following two reactions.

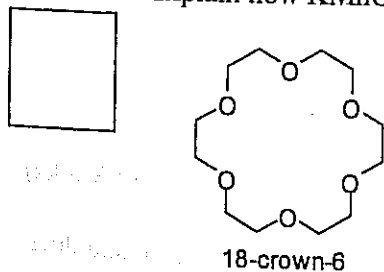


(4 Marks)

9. Give the structures of the products A and B of the following reaction.

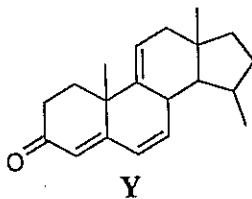
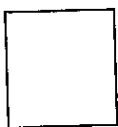


10. Explain how KMnO_4 dissolves in benzene in the presence of 18-crown-6.



(4 Marks)

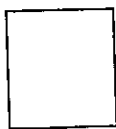
11. Calculate the expected λ_{max} of an aqueous solution of compound Y. Some data that will be useful in your calculation are given below.



Base value for a six membered ring enone	= 215 nm
Base value for a five membered ring enone	= 202 nm
Increments for	
double bond extending conjugation	= 30 nm
alkyl group or ring residue at α	= 10 nm
β	= 12 nm
γ and higher	= 18 nm
exocyclic double bond	= 5 nm
homoannular diene component	= 39 nm
Solvent correction for ethanol	= 00 nm
Solvent correction for water	= - 8 nm

(4 Marks)

12. A is an aliphatic compound and contains C, H, O and N only. A shows peaks at 1735 cm^{-1} and 2200 cm^{-1} but no peaks above 3000 cm^{-1} . Assign the two peaks to functional groups you would expect to be present in A.



IR peak	Functional group
1735 cm^{-1}	
2200 cm^{-1}	

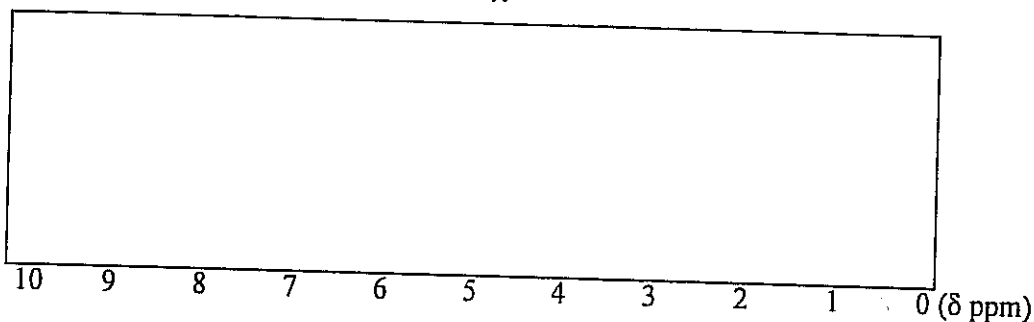
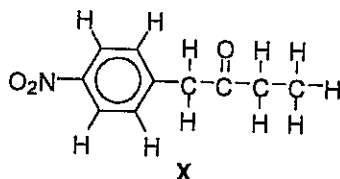
(4 Marks)

13. Mass spectrum of compound show a molecular ion peak at $m/z = 45$. The compound does not contain oxygen. Deduce what element other than C and H are present in the compound?



(2 Marks)

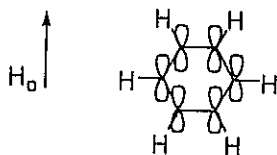
14. The approximate δ values of the resonance signals (peaks) of the compound X are 8.2, 7.2, 3.6, 2.4 and 0.8 ppm. Assign the signals to the hydrogen atoms in X by labelling them as A, B etc. Draw the ^1H NMR spectrum of the compound showing multiplicities of the signals in the box provided.



(5 Marks)

15. When benzene is placed in a magnetic field (H_0) a ring current is created which induces a magnetic field (H).

- (a) In the figure shown below draw the ring current and draw the secondary magnetic field generated by the ring current.
 (b) Indicate by an equation how the protons outside the ring are deshielded.



16. Explain the following observation.

(5 Marks)

Compound	C-C single bond length (\AA)
$\text{H}_3\text{C}-\text{CH}_3$	1.54
$\text{H}_2\text{C}=\text{CH}-\text{CH}=\text{CH}_2$	1.47

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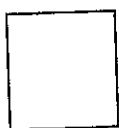
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(3 Marks)

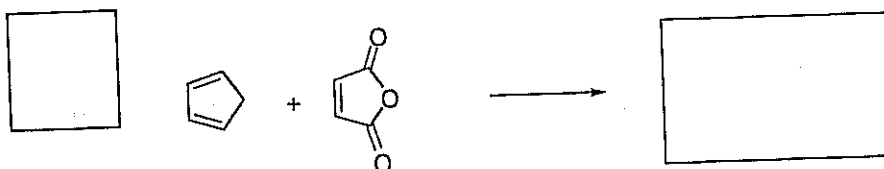
17. Draw the π molecular orbital diagram of cyclooctatetraene and determine whether it is aromatic or not.



cyclooctatetraene

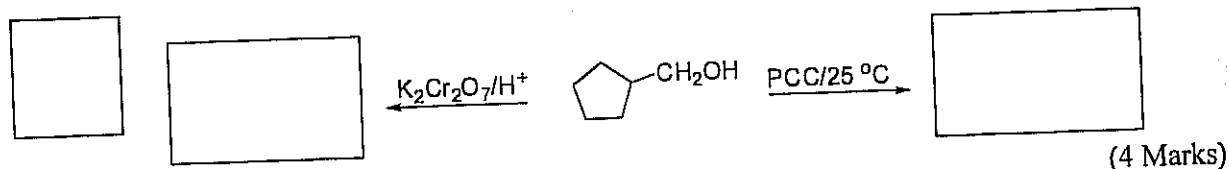
(6 Marks)

18. Give the structure of the product of the following reaction.



(2 Marks)

19. Give the structures of the products of the following reactions.

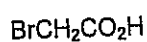
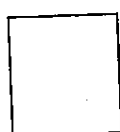


(4 Marks)

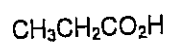


(3 Marks)

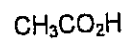
20. Arrange the following acids in the order of increasing acidity.



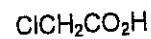
A



B



C

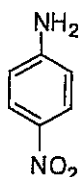
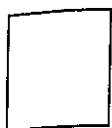


D

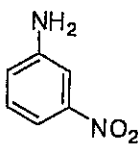
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(2 Marks)

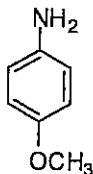
21. Arrange the following amines in the order of increasing pK_b values.



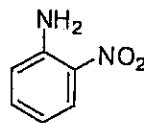
A



B



C

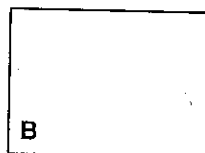
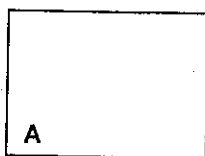
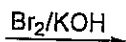
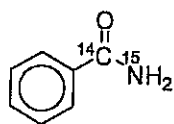


D

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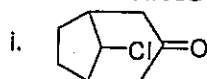
(3 Marks)

22. Predict the structures of the products **A** and **B** in the following reaction. Indicate the position of labelling in the products.



(6 Marks)

23. Give the IUPAC names of the following compounds.



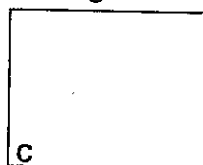
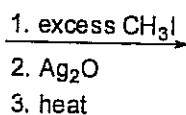
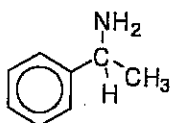
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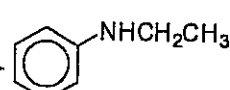
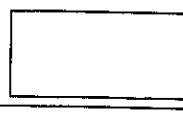
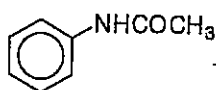
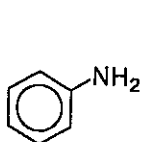
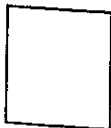
(4 Marks)

24. Predict the product **C** expected in the following reactions.



(3 Marks)

25. (i) Give the reagents required to effect the following reactions.

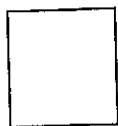


(ii) Will the product obtained by treating **D** with *p*-toluene sulphonyl chloride dissolve in KOH

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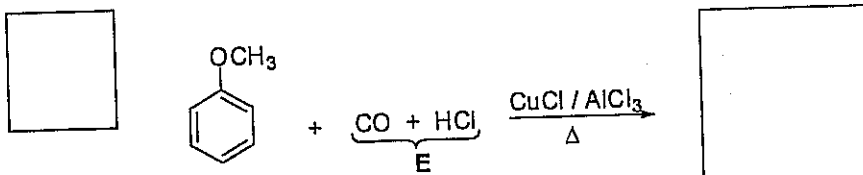
(4 Marks)

26. Draw resonance structures to show that chlorine atom of chlorobenzene directs electrophiles *ortho/para* positions of benzene ring.

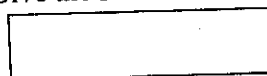


(4 Marks)

27. (i) Indicate the product(s) expected in the following reaction.

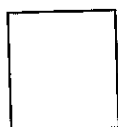


(ii) The reactant **E** required for the above reaction is produced in the reaction mixture by the reaction of HCl and CO. Give the structure of the compound **E**.



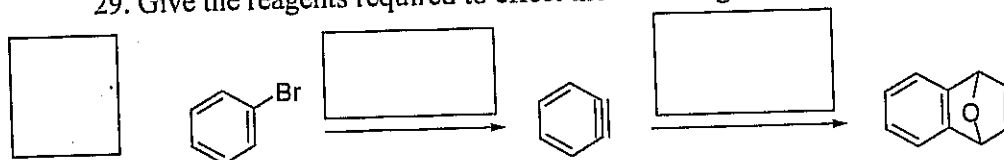
(4 Marks)

28. Aniline reacts with NaNO_2/HCl at $0-5^\circ\text{C}$ to give a product **F** which reacts with excess *N,N*-dimethylaniline to give a yellow coloured compound **G**. Draw the structure of **G**.



(4 Marks)

29. Give the reagents required to effect the following reaction sequence.



(4 Marks)

30. Give the mechanism involved in the following reaction. Indicate the product formed in the reaction



(4 Marks)