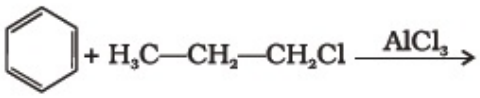
Hydrocarbons

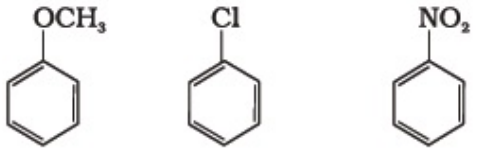
Short Answer Type Questions

1. Why do alkenes prefer to undergo electrophilic addition reaction while arenes prefer electrophilic substitution reactions? Explain.
2. Alkynes on reduction with sodium in liquid ammonia form trans alkenes. Will the butene thus formed on reduction of 2-butyne show the geometrical isomerism?
3. Rotation around carbon-carbon single bond of ethane is not completely free. Justify the statement.
4. Draw Newman and Sawhorse projections for the eclipsed and staggered conformations of ethane. Which of these conformations is more stable and why?
5. The intermediate carbocation formed in the reactions of HI, HBr and HCl with propene is the same and the bond energy of HCl, HBr and HI is 430.5 kJ mol^{-1}, 363.7 kJ mol^{-1} and 296.8 kJ mol^{-1} respectively. What will be the order of reactivity of these halogen acids?
6. What will be the product obtained as a result of the following reaction and why?



7. How will you convert benzene into
   - (i) p – nitrobromobenzene
   - (ii) m – nitrobromobenzene

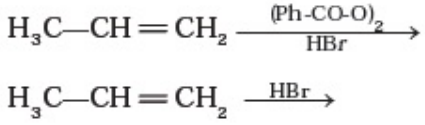
8. Arrange the following set of compounds in the order of their decreasing relative reactivity with an electrophile.Give reason.



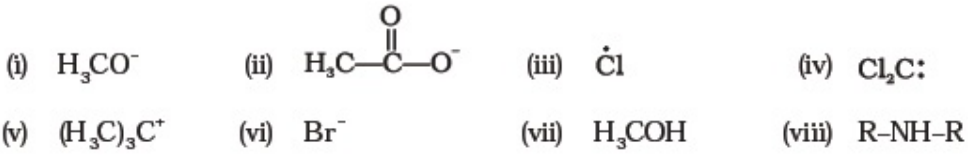
9. Despite their – I effect, halogens are o- and p-directing in haloarenes. Explain.
10. Why does presence of a nitro group make the benzene ring less reactive in comparison to

the unsubstituted benzene ring. Explain.

11. Suggest a route for the preparation of nitrobenzene starting from acetylene?
12. Predict the major product (s) of the following reactions and explain their formation.

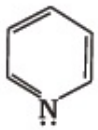


13. Nucleophiles and electrophiles are reaction intermediates having electron rich and electron deficient centres respectively. Hence, they tend to attack electron deficient and electron rich centres respectively. Classify the following species as electrophiles and nucleophiles.



14. The relative reactivity of 1°, 2°, 3° hydrogen's towards chlorination is 1 : 3.8 : 5. Calculate the percentages of all monochlorinated products obtained from 2-methylbutane.
15. Write the structures and names of products obtained in the reactions of sodium with a mixture of 1-iodo-2-methylpropane and 2-iodopropane.
16. Write hydrocarbon radicals that can be formed as intermediates during monochlorination of 2-methylpropane? Which of them is more stable? Give reasons.
17. An alkane C_8H_{18} is obtained as the only product on subjecting a primary alkyl halide to Wurtz reaction. On monobromination this alkane yields a single isomer of a tertiary bromide. Write the structure of alkane and the tertiary bromide.
18. The ring systems having following characteristics are aromatic.
    - (i) Planar ring containing conjugated π bonds.
    - (ii) Complete delocalisation of the π−electrons in ring system i.e. each atom in the ring has unhybridized p-orbital, and
    - (iii) Presence of (4n+2) π−electrons in the ring where n is an integer (n = 0, 1, 2,.....) [Huckel rule].

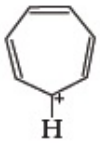
Using this information classify the following compounds as aromatic/nonaromatic.


(A)


(B)


(C)


(D)


(E)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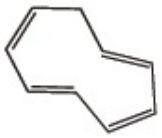
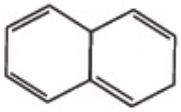
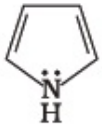

(G)

19. Which of the following compounds are aromatic according to Huckel's rule?

(A) 

(B) 

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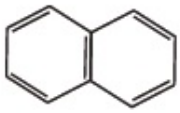
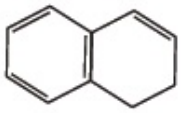
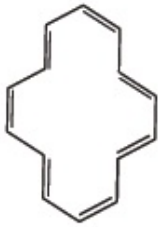
(D) 

(E) 

(F) 

20. Suggest a route to prepare ethyl hydrogen sulphate ($CH_3–CH_2–OSO_2—OH$) starting from ethanol (C_2H_5OH).

Long Answer Type Questions

1. An alkyl halide $C_5H_{11}Br$ (A) reacts with ethanolic KOH to give an alkene 'B', which reacts with Br_2 to give a compound 'C', which on dehydrobromination gives an alkyne 'D'. On treatment with sodium metal in liquid ammonia one mole of 'D' gives one mole of the sodium salt of 'D' and half a mole of hydrogen gas. Complete hydrogenation of 'D' yields a straight chain alkane. Identify A,B, C and D. Give the reactions involved.
2. 896 mL vapour of a hydrocarbon 'A' having carbon 87.80% and hydrogen 12.19% weighs 3.28g at STP. Hydrogenation of 'A' gives 2-methylpentane.
   Also 'A' on hydration in the presence of H_2SO_4 and $HgSO_4$ gives a ketone 'B' having molecular formula $C_6H_{12}O$. The ketone 'B' gives a positive iodoform test. Find the structure of 'A' and give the reactions involved.
3. An unsaturated hydrocarbon 'A' adds two molecules of H_2 and on reductive ozonolysis gives butane-1,4-dial, ethanal and propanone. Give the structure of 'A', write its IUPAC name and explain the reactions involved.
4. In the presence of peroxide addition of HBr to propene takes place according to anti Markovnikov's rule but peroxide effect is not seen in the case of HCl and HI. Explain.