

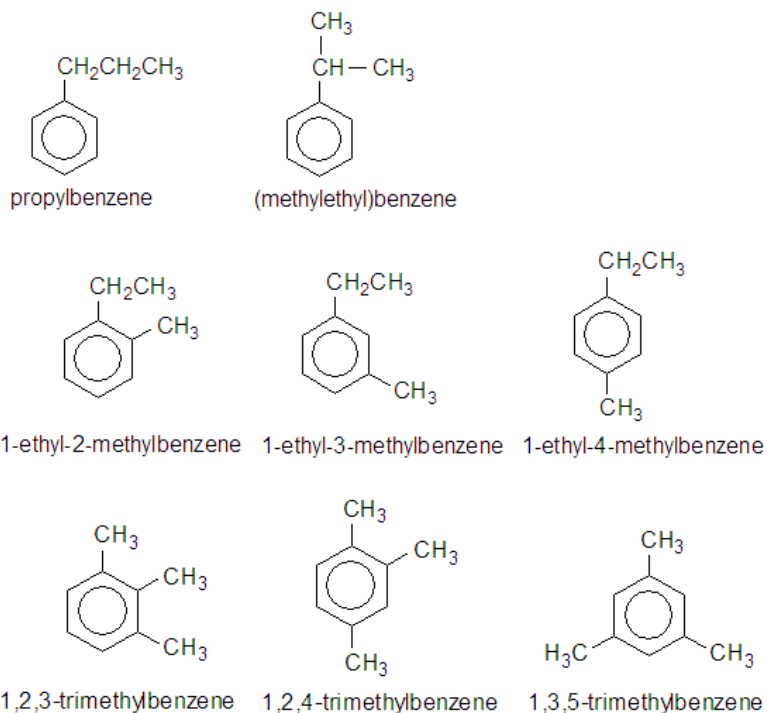


RAFFLES INSTITUTION
YEAR 5 H2 CHEMISTRY 2024
Tutorial 13 – Arenes (Suggested Answers)

Self-Check Questions - Suggested Answers

1(a)

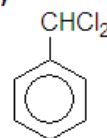
Isomeric arenes with molecular formula C_9H_{12} :



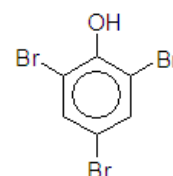
- 1(b)(i)** 4-bromo-1,2-dimethylbenzene
(ii) (2-chloroethyl)benzene
(iii) 2-ethyl-6-methylbenzoic acid
(iv) phenylethene

1(c)

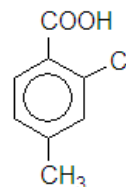
(i)



(ii)



(iii)



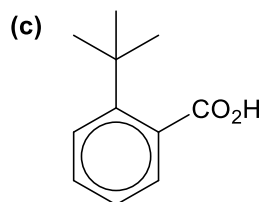
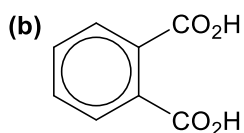
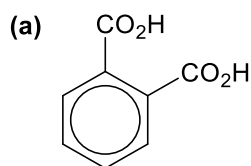
2 In decreasing order of reactivity towards nitration:

ethylbenzene > benzene > benzoic acid

Ethylbenzene : The ethyl group is an electron-donating group which increases the electron density of the benzene ring, making it more susceptible to electrophilic attack by NO_2^+ than an unsubstituted benzene ring.

Benzoic acid : The $-COOH$ group is an electron-withdrawing group which decreases the electron density of the benzene ring, making it less susceptible to electrophilic attack by NO_2^+ than an unsubstituted benzene ring.

3



4

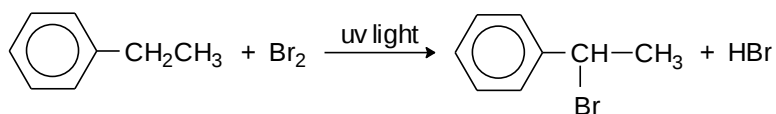
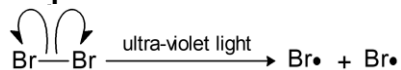
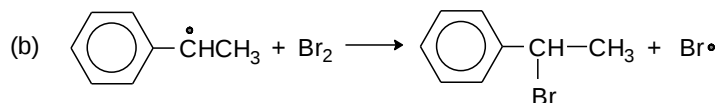
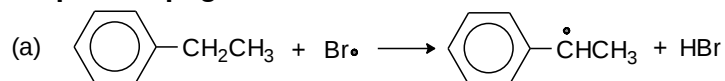
(a) TestAdd Br₂ in CCl₄ drop-wise to each compound in a test-tube at room temperature.Observation

- For cyclohexene, there is (rapid) decolourisation of orange-red Br₂.
- For benzene, there is no decolourisation of orange-red Br₂.

(b) TestAdd two drops of KMnO₄ acidified with dilute sulfuric acid to each compound in a test-tube, and heat each reaction mixture in a hot water bath. (Note: **DO NOT** heat under reflux)Observation

- For ethylbenzene, there is decolourisation of purple KMnO₄(aq) and effervescence of CO₂(g) which gives a white precipitate with limewater.
- For benzene, there is no decolourisation of purple KMnO₄(aq).

5

**Free-radical Substitution****Step 1: Initiation****Step 2: Propagation**

Then (a), (b), (a), (b), ...

Step 3: Termination