

# CHEMISTRY MUSING

**C**hemistry Musing was started from August '13 issue of Chemistry Today with the suggestion of Shri Mahabir Singh. The aim of Chemistry Musing is to augment the chances of bright students preparing for JEE (Main and Advanced) / AIPMT / AIIMS / Other PMTs & PETs with additional study material. In every issue of Chemistry Today, 10 challenging problems are proposed in various topics of JEE (Main and Advanced) / AIPMT. The detailed solutions of these problems will be published in next issue of Chemistry Today.

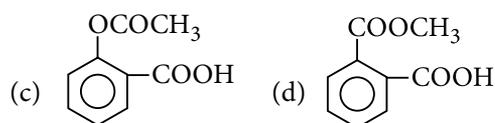
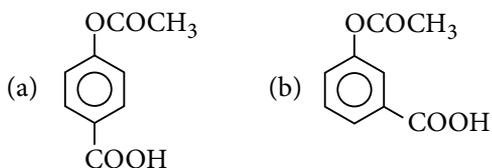
The readers who have solved five or more problems may send their solutions. The names of those who send atleast five correct solutions will be published in the next issue.

We hope that our readers will enrich their problem solving skills through "Chemistry Musing" and stand in better stead while facing the competitive exams.

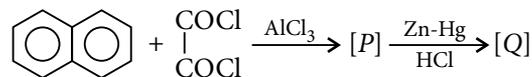
## PROBLEM Set 16

### JEE MAIN/PMTs

- $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  (also known as blue vitriol) is often added to swimming pools to kill algae. It is prepared by the reaction between copper metal and hot sulphuric acid to give  $\text{CuSO}_4(\text{aq})$  and  $\text{SO}_2(\text{g})$ . Molecules of  $\text{SO}_2(\text{g})$  obtained when one mole of copper is reacted with one mole of sulphuric acid are
  - $3.0 \times 10^{23}$
  - $6.023 \times 10^{23}$
  - $3.0 \times 10^{24}$
  - $64 \times 6.023 \times 10^{23}$
- Which of the following is a redox reaction?
  - $2\text{CuSO}_4 + 4\text{KI} \longrightarrow \text{Cu}_2\text{I}_2 + 2\text{K}_2\text{SO}_4 + \text{I}_2$
  - $\text{C}_{12}\text{H}_{22}\text{O}_{11} + \text{H}_2\text{O} \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{C}_6\text{H}_{12}\text{O}_6$
  - $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \longrightarrow \text{BaSO}_4 + 2\text{NaCl}$
  - $\text{CuSO}_4 + 4\text{NH}_3 \longrightarrow [\text{Cu}(\text{NH}_3)_4]\text{SO}_4$
- An organic compound 'A' having vapour density 47, gives characteristic colour with  $\text{FeCl}_3$ . 'A' when treated with  $\text{CO}_2$  and  $\text{NaOH}$  at  $140^\circ\text{C}$  under pressure gives 'B' which on being acidified gives 'C'. It reacts with acetyl chloride to give 'D', a pain killer. The structure of 'D' is



- The equilibrium constant for the reaction  $\text{OCl}^-_{(\text{aq})} + \text{H}_2\text{O}_{(\text{l})} \rightleftharpoons \text{HOCl}_{(\text{aq})} + \text{OH}^-_{(\text{aq})}$  is  $3.6 \times 10^{-7}$ . Hence,  $K_a$  for  $\text{HOCl}$  is
  - $2.8 \times 10^{-8}$
  - $3.6 \times 10^{-7}$
  - $6.0 \times 10^{-1}$
  - $2.8 \times 10^6$
- In the following reaction sequence,



Q is

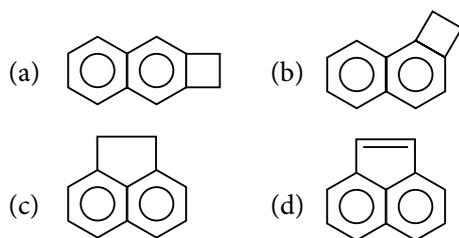
### Solution Senders of Chemistry Musing

#### SET 15

- Devjit Acharjee, Kolkata (West Bengal)
- Patil Basu
- Suraj Chatterjee, Kolkata (West Bengal)

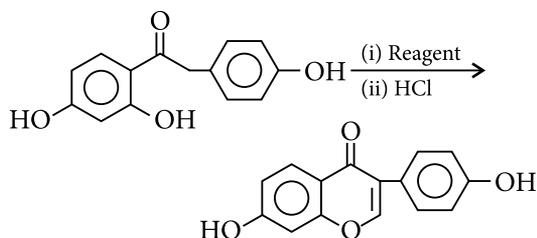
#### SET 14

- Arun Nayan, Ghazipur (Uttar Pradesh)
- Shoumorup Mukhopadhyay, Kolkata (West Bengal)
- Abhishek Bora, Nagaon (Assam)



### JEE ADVANCED

6. Identify the reagent in the given reaction.



- (a) HCHO, C<sub>2</sub>H<sub>5</sub>ONa  
 (b) CH<sub>3</sub>CHO, OH<sup>-</sup>  
 (c) HCOOC<sub>2</sub>H<sub>5</sub>  
 (d) HCOOC<sub>2</sub>H<sub>5</sub>, C<sub>2</sub>H<sub>5</sub>ONa

### COMPREHENSION

On the basis of elemental analysis, the empirical formula as also molecular formula of a chromium complex was found to be CrN<sub>4</sub>H<sub>12</sub>Cl<sub>2</sub>Br. This complex could be isolated in two isomeric forms. One of these two forms was found to produce a white precipitate on reaction with AgNO<sub>3</sub> solution. The white precipitate was found to be readily soluble in dilute aqueous ammonia. The other isomer forms a yellow precipitate on reaction with AgNO<sub>3</sub> and this yellow precipitate is only partly soluble in concentrated ammonia solution.

7. If we measure the conductivity of aqueous solutions of these two isomers, the conductivity of the isomer forming white ppt. with AgNO<sub>3</sub> and that forming yellow ppt. will be found to be as follows :
- (a) conductivity of isomer forming white precipitate with AgNO<sub>3</sub> is more than that of the other

- (b) conductivity of isomer forming yellow precipitate with AgNO<sub>3</sub> will be more than the other  
 (c) conductivity of both the isomers will be same  
 (d) none of the above is correct.

8. In the two isomers,  
 (a) the oxidation state of Cr is +2  
 (b) the number of unpaired electrons is 3  
 (c) the number of unpaired electrons is 2  
 (d) In one, there are two unpaired electrons whereas in the other, there are three unpaired electrons.

### INTEGER VALUE

9. Pure water has reversible reduction potential of -0.413 V under 1.00 atm H<sub>2</sub> pressure. If 2H<sup>+</sup> + 2e<sup>-</sup> → H<sub>2</sub> is considered to be the reduction, then pH of pure water is
10. The value of *n* in the molecular formula Be<sub>*n*</sub>Al<sub>2</sub>Si<sub>6</sub>O<sub>18</sub> is

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