VIDYAPEETH ACADEMY
SINCE 2013
IIT JEE | NEET | FOUNDATION

Head Office: 2nd Floor, Grand Plaza, Fraser Road, Dak Bunglow, Patna - 01

JEE Main 2023 (Memory based)

30 January 2023 - Shift 1

Answer & Solutions

CHEMISTRY

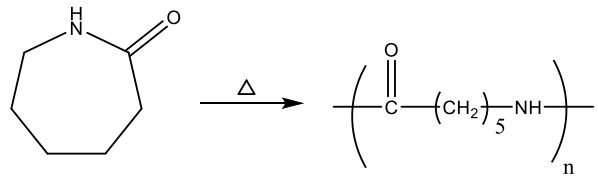
1. Caprolactam when heated at high temperature gives

A. Nylon 6,6
B. Dacron
C. Teflon
D. Nylon 6

Answer (D)

Solution:

Caprolactam on heated at high temperature gives Nylon 6 polymer



Caprolactam Nylon 6

2. Molarity of CO_2 in soft drink is 0.01 M. The volume of soft drink is 300 mL. Mass of CO_2 in soft drink is

A. 0.132 g
B. 0.481 g
C. 0.312 g
D. 0.190 g

Answer (A)

Solution:

Molarity = $\frac{moles\ of\ solute}{Volume\ (L)} = \frac{millimoles}{Volume(mL)}$

millimoles = MV (mL)

millimoles of CO_2 = 0.01 × 300 = 3 or moles of CO_2 = 3×10^{-3}

Mass of CO_2 = moles × Mol.wt

$= 3 \times 10^{-3} \times 44$

$= 132 \times 10^{-3}\ g$

Mass of CO_2 = 0.132 g

3. During the qualitative analysis of SO_3^{2-} using acidified H_2SO_4, SO_2 gas evolved which turns $K_2Cr_2O_7$ solution

A. Green
B. Black
C. Blue
D. Red

Answer (A)

Solution:

Orange of dichromate solution $K_2Cr_2O_7$ converts to green Cr^{3+}

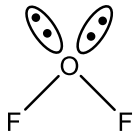
$Cr_2O_7^{2-} + 2SO_3^{2-} + 8H^+ \rightarrow 2Cr^{3+} + 2SO_4^{2-} + 4H_2O$

4. Shape of OF_2 molecule is

A. Bent
B. Linear
C. Tetrahedral
D. T- Shaped

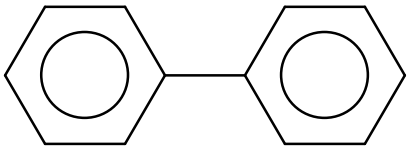
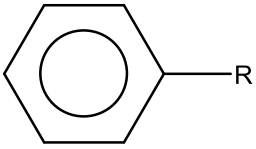
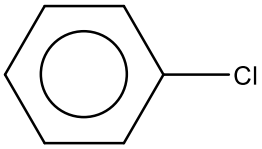
Answer (A)

Solution:



It is sp^3 hybridized therefore it's shape will be Bent or V - Shaped

5. Which of the following option contains correct match:

List – I (Reactions)	List – II (Products)
A. Wurtz	P. 
B. Fittig	Q. R—R
C. Wurtz Fittig	R. 
D. Sandmeyer	S. 

A. A – Q, B – P, C – R, D - S
B. A – P, B – Q, C – R, D - S
C. A – S, B – R, C – Q, D - P
D. A – R, B – S, C – P, D - Q

Answer (A)

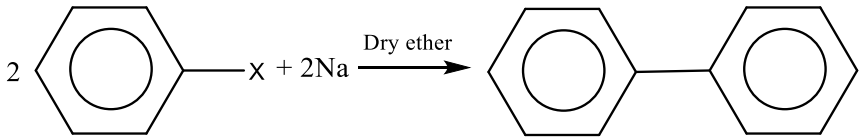
Solution:

The correct matches are

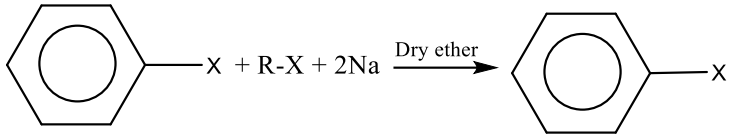
A. Wurtz reaction

$$2\ \text{R-X} + 2\text{Na} \xrightarrow{\text{Dry ether}} \text{R-R} + 2\text{NaX}$$

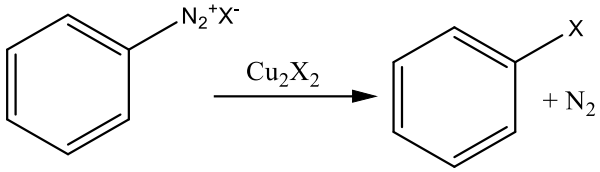
B. Fittig reaction



C. Wurtz-Fittig reaction



D. Sandmeyer reaction



6. For a given cell at T K,
Pt / H_2 (g)/ H^+ // Fe^{3+}/ Fe^{2+}/ Pt
(1 bar) (1 M)
E cell = 0.712 V
E^0 cell = 0.770 V
If $\frac{[Fe^{2+}]}{[Fe^{3+}]}$ is t ($\frac{2.303\,RT}{F} = 0.058$)
Find ($\frac{t}{5}$)

Answer (2)

Solution:

$$0.712 = 0.770 - \frac{0.058}{2}\log\left(\frac{Fe^{2+}}{Fe^{3+}}\right)^2$$

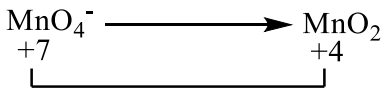
$$-0.058 = -0.058\log\frac{[Fe^{2+}]}{[Fe^{3+}]}$$

$$\frac{Fe^{2+}}{Fe^{3+}} = 10 = t$$

$$\frac{t}{5} = 2$$

7. How many moles of electrons are required to reduce 1 mole of permanganate ions into manganese dioxide

Answer (3)



n-factor = 3

Therefore, 3 moles of electrons are required.

8. 600 mL of 0.04M HCl is mixed with 400mL of 0.02M H_2SO_4. Find the pH of the resulting solution.

Answer (1.40)

Solution:

moles of H^+ from HCl = 0.04 x 600

= 24 mol

moles of H^+ from H_2SO_4 = 0.02 x 2 x 400

= 16 mol

Total moles of H^+ = 24+16 = 40 mol

Final volume of solution = 1000 mL

$[H^+] = \frac{40}{1000}$ = 0.04 M

pH = -log (0.04) = 1.4

9. A solution of 2g of a solute and 20g water has boiling point 373.52 K. Then find the molecular mass of solute? [Given: K_b = 0.52 K kg/mole and solute is non-electrolyte]

Answer (100)

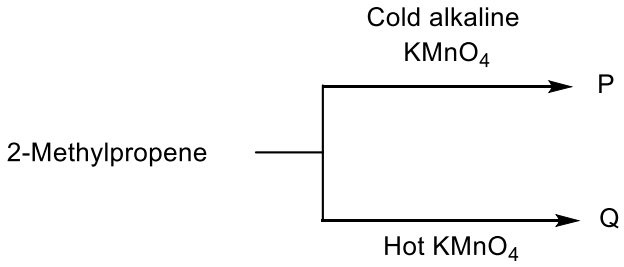
Solution:

$\Delta T_b = K_b . m$

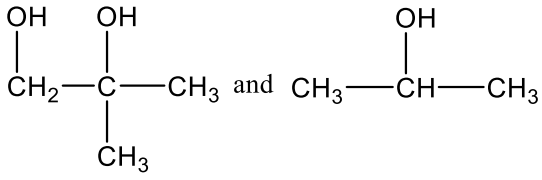
$0.52 = 0.52 \times \frac{2/M}{0.02}$ (M indicates molecular mass of solute)

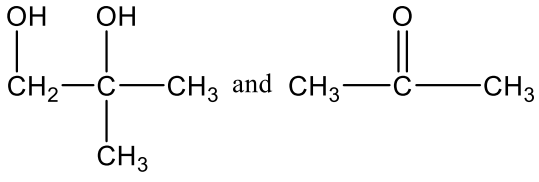
M = 100 g

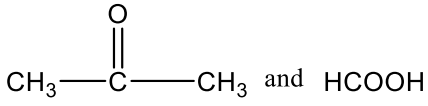
10. Consider the following reactions:

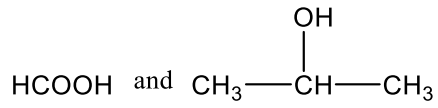


The Product P and Q respectively are?

A. 

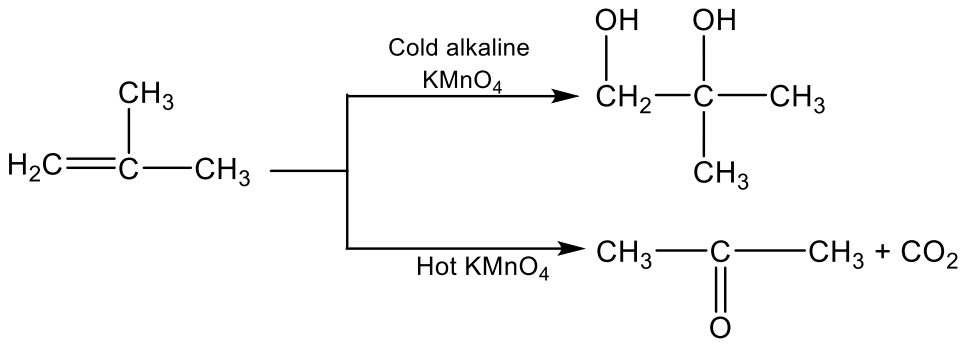
B. 

C. 

D. HCOOH and 

Answer (B)

Solution:



11. Assertion: ketos gives seliwanoff test
Reason: ketos undergoes β- elimination to form furfural

A. Assertion and reason both are correct and reason is the correct explanation of assertion
B. Assertion and reason both are correct but reason is not the correct explanation of assertion
C. Assertion is correct and reason is incorrect
D. Assertion is incorrect but reason is correct

Answer (A)

Solution:

Seliwanoff's reagent is a mixture of resorcinol and concentrated hydrochloric acid. This test distinguishes ketoses like fructose from other sugars, because in this test, only ketose sugars can produce the furfurals which form colored complexes with resorcinol.

12. The role of SiO_2 in Cu extraction is:

A. Converts FeO to $FeSiO_3$
B. Converts $\mathrm{Ca}O$ to $\mathrm{Ca}SiO_3$
C. Reduces Cu_2S to Cu
D. None of these

Answer (A)

Solution:

SiO_2 behaves as flux and reacts with impurity (FeO) to form slag ($FeSiO_3$)
$FeO + SiO_2 \rightarrow FeSiO_3$.

13. Which of the following compound is used as antacid?

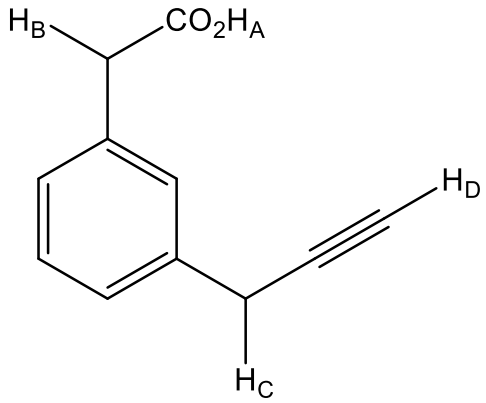
A. Ranitidine
B. Prontosil
C. Norethindrone
D. Codeine

Answer (A)

Solution:

Ranitidine is used as an antacid

14. Consider the following molecule



Select the correct order of the acidic strength

A. $\mathrm{H_A} > \mathrm{H_D} > \mathrm{H_B} > \mathrm{H_C}$
B. $\mathrm{H_B} > \mathrm{H_A} > \mathrm{H_D} > \mathrm{H_C}$
C. $\mathrm{H_A} > \mathrm{H_B} > \mathrm{H_C} > \mathrm{H_D}$
D. $\mathrm{H_C} > \mathrm{H_B} > \mathrm{H_D} > \mathrm{H_A}$

Answer (A)

Solution:

Acidic strength α Stability of conjugate base

Therefore,
The correct order of acidic strength $\mathrm{H_A} > \mathrm{H_D} > \mathrm{H_B} > \mathrm{H_C}$

15. Arrange the following ligands according to their increasing order of field strength
S^{2-}, $C_2O_4^{2-}$, NH_3, en, CO

A. $S^{2-} < CO < NH_3 < en < C_2O_4^{2-}$
B. $S^{2-} < NH_3 < en < CO < C_2O_4^{2-}$
C. $S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$
D. $CO < C_2O_4^{2-} < NH_3 < en < S^{2-}$

Answer (C)

Solution:

The correct order of field strength as per the spectrochemical series is
$S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$

16. If volume of ideal gas is increased isothermally than its internal energy

A. Increases
B. Remains constant
C. Decreases
D. Can be increased or decreased

Answer (B)

Solution:

$\Delta U = nC_v \Delta T$

And for an isothermal process $\Delta T = 0$

Therefore,

For isothermal expansion of ideal gas $\Delta U = 0$

17. For first order kinetic rate constant $2.011 \text{x } 10^{-3}\ sec^{-1}$. The time taken for the decomposition of substance from 7g to 2g will be:
(Use log7 = 0.845 and log2 = 0.301)

Answer (623)

Solution:

A → products

Initial moles of A = $\frac{7}{M}$ (M is molar mass of A)

Final moles of A = $\frac{2}{M}$

Rate constant k = $2.011 \times 10^{-3} s^{-1}$

For a first order reaction

$t = \frac{2.303}{k} \log \frac{7}{2}$

$= \frac{2.303}{2.011} \times 10^{-3} [0.845 - 0.301]$

= 623 sec

18. Consider the following reactions

$NO_2 \xrightarrow{UV} A + B$

$A + O_2 \rightarrow C$

$B + C \rightarrow NO_2 + O_2$

A, B and C respectively are

A. O, NO, O_3
B. NO, O, O_3
C. NO, O_3, O
D. O_3, O, NO

Answer (A)

Solution:

$NO_2 \xrightarrow{UV} NO + O$

(B) (A)

$O + O_2 \rightarrow O_3$

(C)

$NO + O_3 \rightarrow NO_2 + O_2$

19. No. of lone pairs of central atoms are given.
Match the following.

Column 1	Column 2
A. IF_7	P. 0
B. ICl_4^-	Q. 1
C. XeF_2	R. 2
D. XeF_6	S. 3

A – P, B – Q, C – R, D – S

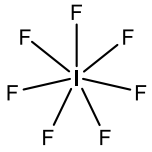
E. A – P, B – R, C – S, D - Q

F. A – R, B – S, C – P, D - Q

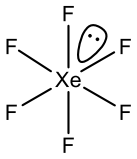
G. A – S, B – R, C – Q, D - P

Answer (B)

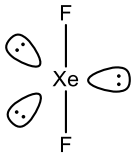
Solution:



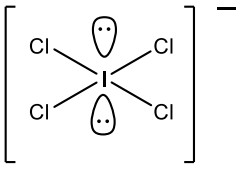
L.P = 0



L.P = 1



L.P = 3



L.P = 2

20. Which one of the following is water soluble?

a. $BeSO_4$
b. $MgSO_4$
c. $CaSO_4$
d. $SrSO_4$
e. $BaSO_4$

A. Only a & b

B. Only a, b, c

C. Only d & e

D. Only a & e

Answer (A)

Solution:

Solubility of sulphates of group-2 elements decreases down the group. $BeSO_4$ and $MgSO_4$ are appreciably soluble in water. $CaSO_4$, $SrSO_4$ and $BaSO_4$ are practically insoluble in water.

21. Inhibitor of cancer growth

A. Cis-platin

B. EDTA

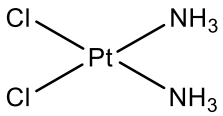
C. Cobalt

D. Ethanol 1, 2-diamine

Answer (A)

Solution:

Cis-platin acts as an anticancer agent.



22. Speed of e^- in 7th orbit is 3.6 x 10^6 m/s, then find the speed in 3rd orbit.

A. 3.6 x 10^6 m/s
B. 8.4 x 10^6 m/s
C. 7.5 x 10^6 m/s
D. 1.8 x 10^6 m/s

Answer (B)

Solution:

Speed of electron in nth orbit of a Bohr atom is given by

$v_n = (v_1)_H \times \frac{z}{n}$

If n = 7

$v_7 = (v_1)_H \times \frac{z}{n} = 3.6 \times 10^6\ m/s$

$\Rightarrow (v_1)_H \times Z = 3.6 \times 10^6 \times 7$ → Eq -1

If n = 3

$v_3 = (v_1)_H \times \frac{z}{3}$

Putting value of $(v_1)_H \times Z$ from Eq - 1

$= \frac{7 \times 3.6 \times 10^6}{3}$

$= 8.4 \times 10^6\ m/s$

23. Match the following.

Atomic no	Group
i. 52	P. s
ii. 37	Q. p
iii. 65	R. f
iv. 74	S. d

A. (i) - Q, (ii) - P, (iii) - R, (iv) - S
B. (i) - Q, (ii) - P, (iii) - S, (iv) - R
C. (i) - S, (ii) - R, (iii) – P, (iv) - Q
D. (i) - R, (ii) - P, (iii) - Q, (iv) – S

Answer (B)

Solution:

f - block elements → Lanthanoids = 57 - 71
f - block elements → Actinoids = 89 - 103

65: f - block

37: $[Kr]5s^1 \rightarrow s - block$

52: $[Kr]5s^2 4d^{10} 5p^4 \rightarrow p - block$

74: $[Xe]6s^2 4f^{14} 5d^4 \rightarrow d - block$