

CHEMISTRY

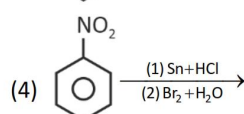
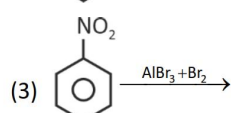
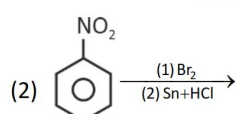
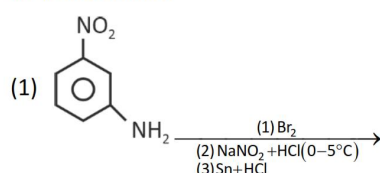
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$$67.05 \text{ mL weighs } \frac{28}{22400} \times 67.05$$

0.0838 g

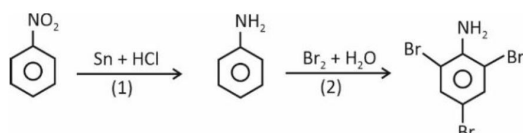
$$\% \text{ of N} = \frac{0.0838}{0.4} \times 100 = 20.95$$

4. Which of the following reagent is used to prepare tribromoaniline?



Answer (4)

Sol.



Step (1) involves reduction of nitrobenzene to aniline and step (2) involves bromination of aniline to give 2, 4, 6-tribromoaniline

5. Match the following list-I with list-II :

List-I (Groups)	List-II (Elements)
(A) Pnictogens	(I) Rn
(B) Chalcogens	(II) At
(C) Halogens	(III) Te
(D) Noble gases	(IV) Bi

- (1) A-I, B-II, C-III, D-IV (2) A-IV, B-III, C-II, D-I
(3) A-IV, B-II, C-III, D-I (4) A-I, B-III, C-II, D-IV

Answer (2)

Sol. Pnictogens → group-15 ⇒ N, P, As, Sb, Bi

Chalcogens → group-16 ⇒ O, S, Se, Te, Po

Halogens → group-17 ⇒ F, Cl, Br, I, At

Noble gases → group-18 ⇒ He, Ne, Ar, Kr, Xe, Rn

6. Find orbital angular momentum for 2s and 2p energy levels

- (1) $0, \frac{h}{(\sqrt{2})\pi}$ (2) $0, \frac{h}{\sqrt{2}\pi}$
(3) $\frac{h}{\pi}, \frac{h}{\pi}$ (4) $0, \frac{h}{2\pi}$

Answer (1)

Sol. Orbital angular momentum = $\frac{h}{2\pi} \sqrt{l(l+1)}$

For 2s $l = 0$

Orbital angular momentum = 0

For 2p $l = 1 \Rightarrow \frac{h}{2\pi} \sqrt{l(l+1)}$

$$\frac{h}{(\sqrt{2})\pi}$$

7. Which of the following order is correct?

- (A) Electronegativity : B > Tl > In > Ga > Al
(B) First Ionisation energy : B > Tl > Ga > Al > In
(C) Density : Tl > In > Ga > Al > B
(D) Size : B > Al > Ga > In > Tl
(1) (A, B, C) only
(2) (B, C, D) only
(3) (A, B, D) only
(4) (A, B, C, D)

Answer (1)**Sol.** EN : B > Tl > In > Ga > Al

(2.0) (1.8) (1.7) (1.6) (1.5)

IE₁ : B > Tl > Ga > Al > In

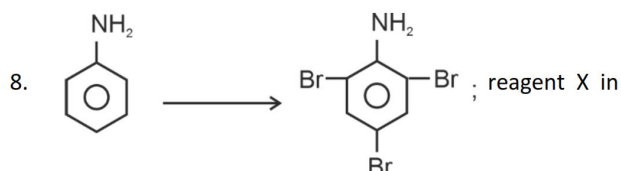
(801) (589) (579) (577) (558) (in kJ/mol)

Density : Tl > In > Ga > Al > B

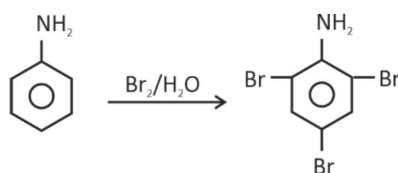
(11.85) (7.31) (5.9) (2.7) (2.35) (in g/ml)

Size : B < Ga < Al < In < Tl

(85) (135) (143) (167) (170) (in pm)



this reaction is

(1) Br₂/CCl₄(2) Br₂/H₂O(3) HBr/H₂SO₄(4) Br₂/acetone**Answer (2)****Sol.** Br₂ in water causes tribrominationH₂O Promotes formation of Br⁺ in excess

9. Which of the following vitamins are fat-soluble?

B₁₂, C, D, B, E

(1) B and C

(2) D and E

(3) B and E

(4) C, D and E

Answer (2)**Sol.** Fat soluble vitamins are (A, D, E and K)10. Statement-I : CrO₃ is a strong oxidising agentStatement-II : Cr⁺⁶ is more stable than Mo⁺⁶

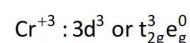
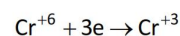
considering the above statements, choose the correct option.

(1) Both statement-I and Statement-II are correct

(2) Both statement-I and Statement-II are incorrect

(3) Statement-I is correct but Statement-II is incorrect

(4) Statement-I is incorrect but Statement-II is correct

Answer (3)**Sol.** CrO₃ is a strong oxidising agent and itself is reduced to Cr³⁺ which is more stable than Cr⁶⁺ because Cr³⁺ has stable electronic configuration.

∴ Statement-I is correct.

Stability of +6 state in group-6 increases down the group. Therefore, Mo⁺⁶ is more stable than Cr⁺⁶. So, statement-II is incorrect.

11. Which of the following compound or complex ions is/are diamagnetic in nature

(a) CrO₃(b) [Fe(CN)₆]⁴⁻(c) [Co(H₂O)₃F₃](d) [Cr(NH₃)₆]³⁺

(1) a and b only

(2) a, b and c only

(3) a, b, c and d

(4) c and d only

Answer (2)

Sol. Species having unpaired electron are paramagnetic in nature

$\text{CrO}_3 \Rightarrow \text{Cr}^{+6} \Rightarrow 0$ unpaired electron hence diamagnetic

$[\text{Fe}(\text{CN})_6]^{4-}$

$\text{Fe}^{2+} \Rightarrow$ with CN^- (SFL)

$\Rightarrow t_{2g}^6 e_g^0$

Number of unpaired electron = 0

$\Rightarrow$ diamagnetic

$[\text{Cr}(\text{NH}_3)_6]^{3+}$

$\text{Cr}^{3+} 3d^3$

$t_{2g}^3 e_g^0$

Number of unpaired electrons = 3

$\Rightarrow$ Paramagnetic

12. 20 mL 1M NaOH is mixed with 10 mL 2M HCl which is further diluted to 100 mL. Find concentration of final solution?

- (1) 2×10^{-3} M
- (2) 0.2 M
- (3) 2×10^{-2} M
- (4) 0.1 M

Answer (2)

Sol. $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$

20×1 10×2

20mmol 20mmol

0 0 20mmol

So, concentration of NaCl = $\frac{20 \text{ mmol}}{100 \text{ mL}}$

= 0.2 M

13. Which of the following statement is correct w.r.t. Arrhenius equation?

- (1) Dimensions of k and A are same
- (2) k decreases with increase in temperature generally
- (3) A decreases with increase in temperature always
- (4) k increases as value of E_a increase

Answer (1)

Sol. $k = Ae^{-\frac{E_a}{RT}}$

$E_a \uparrow \quad k \downarrow$

14. Match the column-I with column-II and choose the correct option

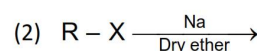
Column I

Column II

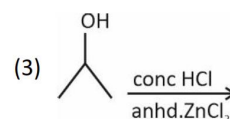
(P) Finkelstein reaction



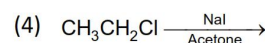
(Q) Lucas Test



(3) Wurtz reaction



(4) Gatterman Koch



Reaction

- (1) $\text{P} \rightarrow (4), \text{Q} \rightarrow (3), \text{R} \rightarrow (2), \text{S} \rightarrow (1)$
- (2) $\text{P} \rightarrow (1), \text{Q} \rightarrow (2), \text{R} \rightarrow (3), \text{S} \rightarrow (4)$
- (3) $\text{P} \rightarrow (1), \text{Q} \rightarrow (3), \text{R} \rightarrow (2), \text{S} \rightarrow (4)$
- (4) $\text{P} \rightarrow (3), \text{Q} \rightarrow (2), \text{R} \rightarrow (1), \text{S} \rightarrow (4)$

Answer (1)

Sol. $\text{P} \rightarrow (4), \text{Q} \rightarrow (3), \text{R} \rightarrow (2), \text{S} \rightarrow (1)$

15. **Statement-I :** When ice and water are at equilibrium, heat is absorbed by system, yet there is no increase in temperature until ice melts completely.

Statement-II : System absorbs the heat to break inter molecular H-bond and there is no increase in kinetic energy.

- (1) Both statement-I and Statement-II are correct
- (2) Statement-I is correct. Statement-II is incorrect
- (3) Statement-I is incorrect. Statement-II is correct
- (4) Both statements-I and II are incorrect

Answer (1)

Sol. Heat absorbed is consumed in conversion of solid ice to liquid water. So no temperature change. Even kinetic energy is same is the transition.

16. **Statement-I :** Wet cotton clothes made up of cellulose based carbohydrates take a comparatively longer time to get dried than wet nylon based clothes.

Statement-II : Both form intermolecular H-bonds with water molecules

- (1) Both statement-I and statement-II are correct
- (2) Both statement-I and statement-II are incorrect
- (3) Statement-I is correct but statement-II is incorrect
- (4) Statement-I is incorrect but statement-II is correct

Answer (1)

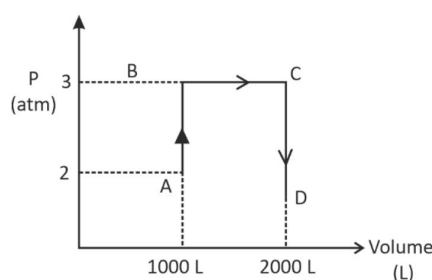
Sol. Wet cellulose-based cotton clothes take longer time to dry than wet nylon-based clothes due to more number of H-bonds between cellulose and water molecules. So statement-I is correct. Statement-II is also correct as both the cellulose and nylon form intermolecular H-bonds with water molecules.

- 17.
- 18.
- 19.
- 20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. Find out magnitude of work done in the process ABCD (in kJ) (1 Latm = 101.3 J)



Answer (304)

Sol. $(W) = 3 \times 1000$

$$= 3000 \text{ atm L}$$

$$(W) = 303900 \text{ Joule}$$

$$= 303.9 \text{ kJ}$$

$$= 304 \text{ kJ}$$

22. Amount of magnesium (Mg) (in mg) required to liberate 224 mL of H_2 gas at STP, when reacted with HCl.

Answer (240)

Sol. $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$

$$\text{Moles of } \text{H}_2 \text{ gas at STP} = \frac{224}{22400} \text{ mol}$$

$$= 0.01 \text{ mol}$$

1 mol H_2 formed by 1 mol of Mg.

mol of Mg required = 0.01 mol

mass of Mg required = 0.01×24

$$= 0.24 \text{ g}$$

$$= 240 \text{ mg}$$



23. Among Sc, Ti, Mn and Co, calculate the spin only magnetic moment in +2 oxidation state of metal having highest heat of atomisation

Answer (3)

Sol. Enthalpy of atomisation

Sc – 326 kJ mol⁻¹

Ti – 473 kJ mol⁻¹

Mn – 281 kJ mol⁻¹

Co – 425 kJ mol⁻¹

Ti has highest heat of atomisation

Ti²⁺ ⇒ 3d²



$$\mu_{\text{spin only}} = \sqrt{n(n+2)} \text{ BM}$$

n = number of unpaired electrons

= 2

$$\mu = \sqrt{2(2+2)}$$

$$= \sqrt{8} \text{ BM}$$

$$= 2.82 \text{ BM}$$

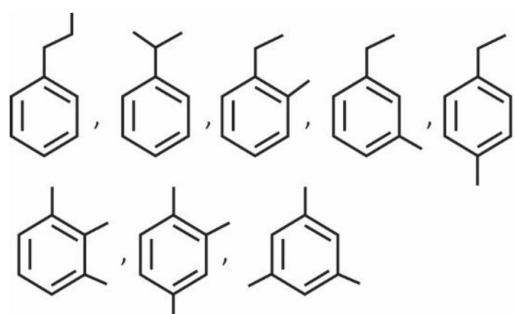
$$\approx 3 \text{ BM}$$

24. C₉H₁₂ is a derivative of benzene, how many total structural isomers of molecular formula C₉H₁₂ are possible.

Answer (8)

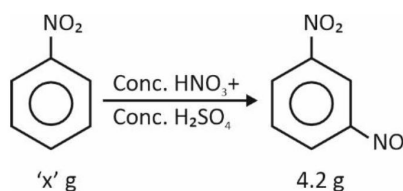
Sol. Degree of unsaturation =

$$\frac{2 \times 9 + 2 - 12}{2} = 4$$



25. 'x' g of nitrobenzene gives 4.2 g 1, 3-dinitrobenzene with 100% yield. Find the value of 'x'.

Answer (3)



Sol.

Molar mass of C₆H₅NO₂ = 123 g mol⁻¹

Molar mass of C₆H₄(NO₂)₂ = 168 g mol⁻¹

No. of moles of C₆H₅NO₂ = No of moles C₆H₄(NO₂)₂

$$\frac{x}{123} = \frac{4.2}{168}$$

$$x = 3.075 \text{ g} \approx 3 \text{ g}$$