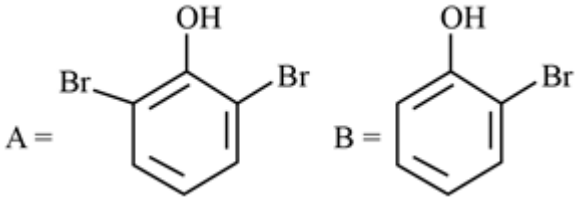
JEE-Main-26-08-2021-Shift-1 (Memory Based)

CHEMISTRY

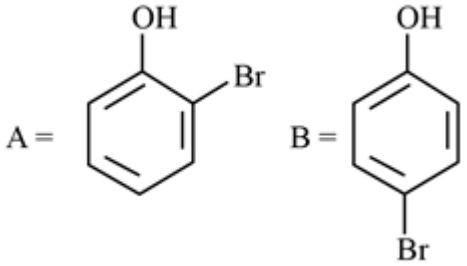
Question: By which of the following process deionized water can be obtained?
Options:
(a) Calgon's process
(b) Synthetic resin method
(c) Clark's method
(d) Permutit
Answer: (b)
Solution: Pure de-mineralised (de-ionized) water free from all soluble mineral salts is obtained by passing water successively through a cation exchange (in the H^+ form) and an anion-exchange (In the OH^- form) resins.

Question: How many electrons are present in 4f orbital of Gd^{2+}?
Options:
(a) 7
(b) 8
(c) 6
(d) 5
Answer: (a)
Solution: Electronic configuration of Gd^{2+} is $[Xe]4f^7$

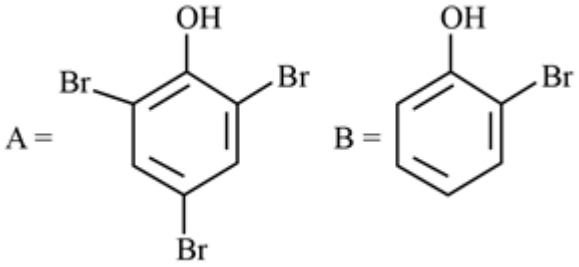
Question: Reaction of phenol with Br_2 and H_2O gives A and reaction of phenol with Br_2 and CS_2 at less than 5°C gives B. Find the product A and B
Options:
(a)



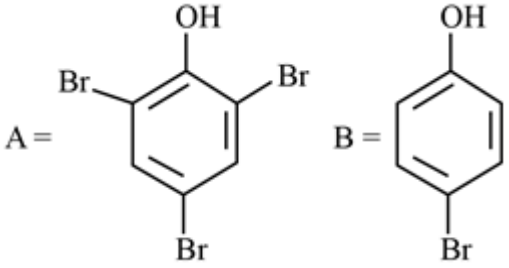
(b)



(c)

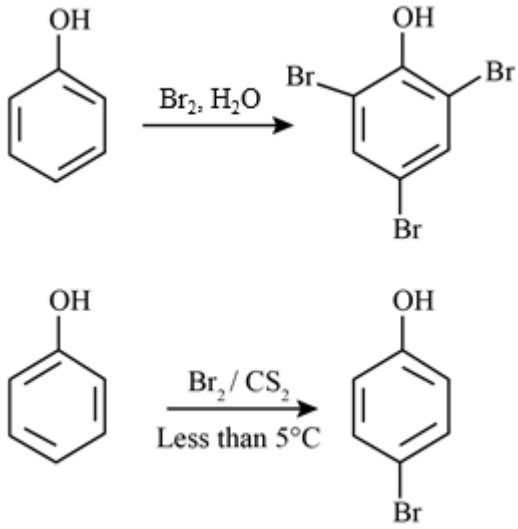


(d)



Answer: (d)

Solution:



Question: S1: Ellingham diagram is used to check which metal oxide is to be reduced by which compound.
S2: In Ellingham diagram as we move from left to right, ΔS always increases.

Options:

(a) Both S1 and S2 are correct.
(b) S1 is correct but S2 is incorrect.
(c) S1 is incorrect but S2 is correct.
(d) Both S1 and S2 are incorrect.

Answer: (b)

Solution: ΔH (enthalpy change) and the ΔS (entropy change) values for any chemical reaction remain nearly constant even on varying temperature. So the only dominant variable becomes T. However. ΔS depends much on the physical state of the compound. Since entropy depends on disorder or randomness in the system. It will increase if a compound melt (s $\rightarrow$ l) or vaporises (l $\rightarrow$ g) since molecular randomness increases on changing the phase from solid to liquid or from liquid to gas.

Question: S1: In Bohr's model velocity of electron increases with decrease in positive charge of nucleus as electrons are not held tightly.
S2: Velocity decreases with an increase in principal quantum number.
Options:
(a) Both S1 and S2 are correct.
(b) S1 is correct but S2 is incorrect.
(c) S1 is incorrect but S2 is correct.
(d) Both S1 and S2 are incorrect.
Answer: (c)
Solution:

$$v = 2.18 \times 10^6 \frac{Z}{n}$$

As positive charge on the nucleus (Z) decreases, velocity will also decrease. As principal quantum number (n) increases, the velocity decreases.

Question: S1: Frenkel defect is interstitial as well as vacancy effect
S2: In Frenkel defect, solids show colour because of F-centre.
Options:
(a) Both S1 and S2 are correct.
(b) S1 is correct but S2 is incorrect.
(c) S1 is incorrect but S2 is correct.
(d) Both S1 and S2 are incorrect.
Answer: (b)
Solution: In Frenkel Defect the smaller ion (usually cation) is dislocated from its normal site to an interstitial site. It creates a vacancy defect at its original site and an interstitial defect at its new location. F-centres are shown by crystals showing metal excess defect.

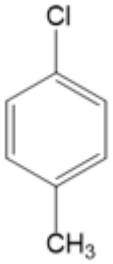
Question: On heating novolac with formaldehyde which of the following polymers will form?
Options:
(a) Melamine
(b) Resin
(c) Bakelite
(d) Polystyrene
Answer: (c)
Solution: Bakelite is a polymer made up of the monomers phenol and formaldehyde. This phenol-formaldehyde resin is a thermosetting polymer.

Question: S1: Methyl orange is suitable indicator for titration of strong acid and weak base
S2: Phenolphthalein is not suitable indicator for titration of acetic acid and NaOH
Options:
(a) Both S1 and S2 are correct.
(b) S1 is correct but S2 is incorrect.
(c) S1 is incorrect but S2 is correct.
(d) Both S1 and S2 are incorrect.
Answer: (b)
Solution: Methyl orange indicator is used in the strong acid weak base titration.

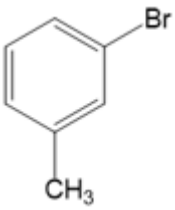
Phenolphthalein changes colour at a pH above 7. So, it is quite good as an indicator for titrations of strong acids with strong bases. It is also suitable for titrations of weak acids and strong bases, which have an equivalence point at a pH above 7.

Question: Which of the following will dissolve in water and give colour?
Options:
(a) Cu_2Cl_2
(b) $CuCl_2$
(c) AgBr
(d) $ZnCl_2$
Answer: (b)
Solution: $CuCl_2$ gives blue-green coloured aqueous solution

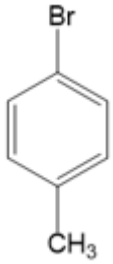
Question: Which of the following reagents gives yellow precipitate for the following sequence -
(i) NaOH, (ii) dil. HNO_3, (iii) $AgNO_3$?
Options:
(a)



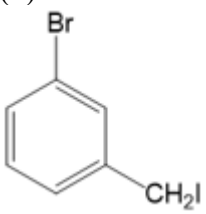
(b)



(c)



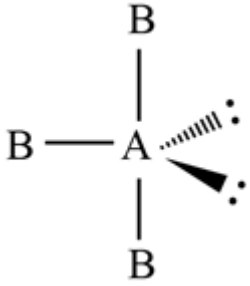
(d)



Answer: (d)
Solution: Silver nitrate test is carried out to detect the type of halide ion in a given solution. The solution is first acidified by adding dilute HNO_3 followed by silver nitrate

solution. F^-, Cl^-, Br^- & I^- react as given below.
$Ag^+_{(aq)} + F^-_{(aq)} \rightarrow AgF$ (No precipitate as it is soluble.)
$Ag^+_{(aq)} + Cl^-_{(aq)} \rightarrow AgCl_{(s)}$ (white precipitate.)
$Ag^+_{(aq)} + Br^-_{(aq)} \rightarrow AgBr_{(s)}$ (pale cream precipitate.)
$Ag^+_{(aq)} + I^-_{(aq)} \rightarrow AgI_{(s)}$ (pale yellow precipitate.)

Question: Interhalogen compound AB_3 has T-shaped structure, how many lone pairs are present on A?
Options:
(a) 2
(b) 3
(c) 1
(d) 0
Answer: (a)
Solution:

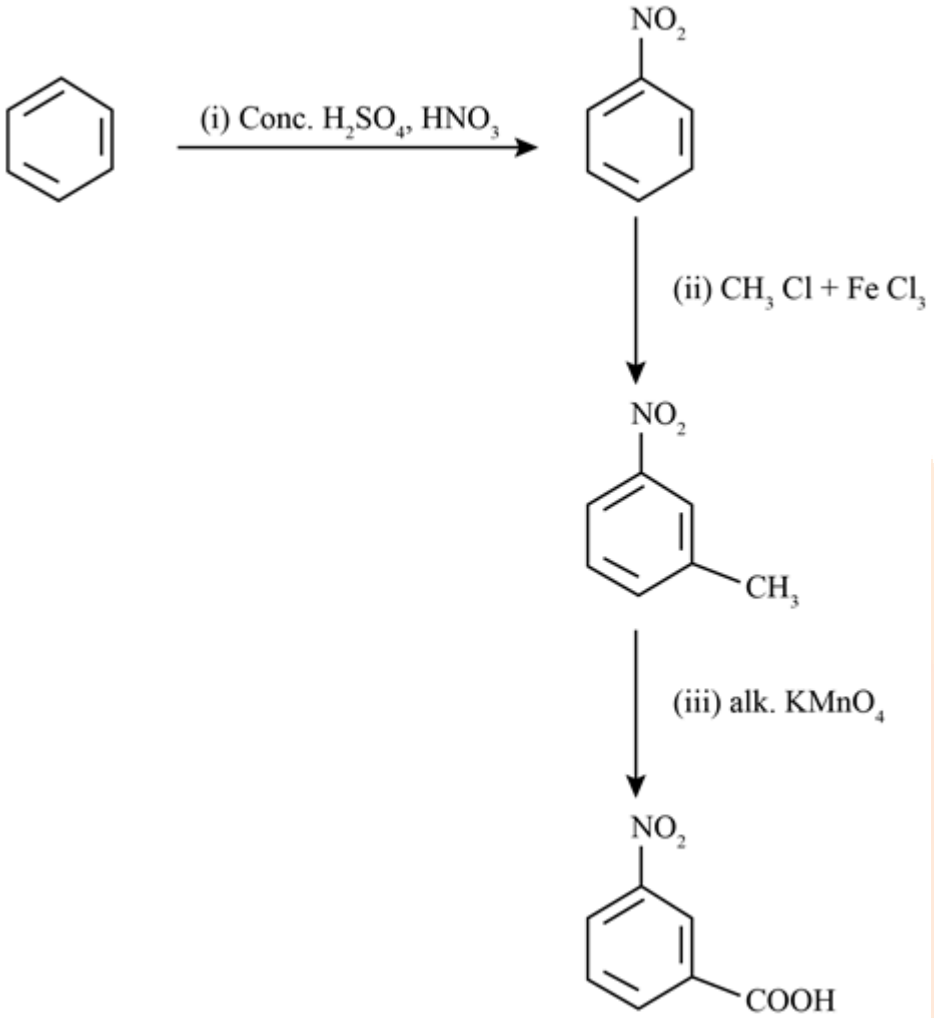


Question: Which is a violet compound among these?
Options:
(a) $[Fe(CN)_5NOS]^{4-}$
(b) $[Fe(CN)_6]^{4-}$
(c) $[Fe(CN)_6]^{3-}$
(d) $Fe(SCN)_3$
Answer: (a)
Solution: $[Fe(CN)_5NOS]^{4-}$ Nitroprusside ion is of violet colour

Question: Which of the following is true for adsorption of gas on a solid surface?
Options:
(a) $\Delta H > 0, \Delta S > 0$
(b) $\Delta H > 0, \Delta S < 0$
(c) $\Delta H < 0, \Delta S > 0$
(d) $\Delta H < 0, \Delta S < 0$
Answer: (d)
Solution: Adsorption is an exothermic process. In other words, ΔH of adsorption is always negative. When a gas is adsorbed, the freedom of movement of its molecules become restricted. This amounts to decrease in the entropy of the gas after adsorption, i.e., ΔS is negative.

Question: Which of the following is the correct sequential method to convert benzene to 3-nitrobenzoic acid?
Options:
(a) (i) $CH_3Cl + FeCl_3$, (ii) Conc. H_2SO_4, HNO_3 (iii) alkaline $KMnO_4$
(b) (i) Conc. H_2SO_4, HNO_3, (ii) $CH_3Cl + FeCl_3$ (iii) alkaline $KMnO_4$

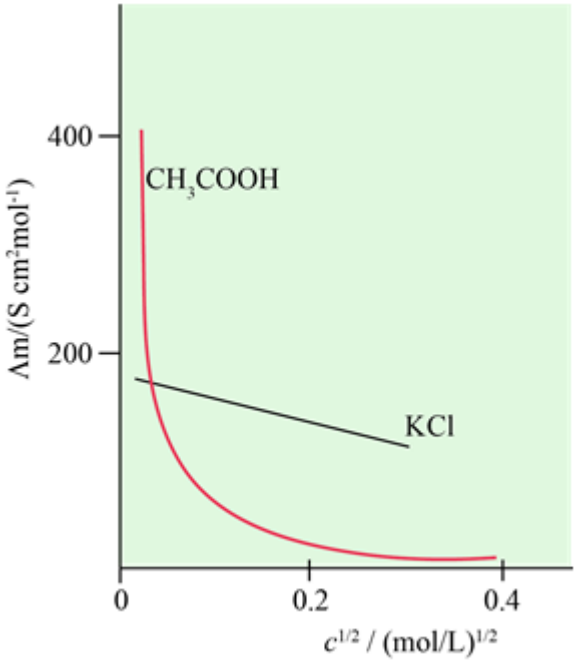
(c) (i) alkaline $KMnO_4$, (ii) $CH_3Cl + FeCl_3$ (iii) conc. H_2SO_4, HNO_3
(d) (i) alkaline $KMnO_4$, (ii) conc. H_2SO_4, HNO_3 (iii) $CH_3Cl + FeCl_3$
Answer: (b)
Solution:



Question: Which of the following statements are correct?
Options:
(a) F_2 is better reducing agent than Cl_2
(b) Cl_2 is more reactive than ClF
(c) F_2 is more reactive than ClF
(d) The fluorine atom can expand its octet
Answer: (c)
Solution: In general, interhalogen are more reactive than halogens (except fluorine)

Question: S1: The y-intercept in the molar conductance vs. concentration graph is always greater for strong electrolyte than weak electrolyte.
S2: On decreasing the conc., molar conductivity decrease
Options:
(a) Both S1 and S2 are correct.
(b) S1 is correct but S2 is incorrect.
(c) S1 is incorrect but S2 is correct.
(d) Both S1 and S2 are incorrect.

Answer: (d)
Solution:



Limiting molar conductance for weak electrolyte may be greater than that for strong electrolyte.
On decreasing the concentration, molar conductance increases.

Question: Which of the following represents correct formula of hydroxyapatite?
Options:
(a) $3Ca_3(PO_4)_2.Ca(OH)_2$
(b) $3Ca_3(PO_4)_2.CaF_2$
(c) $CaSO_4$
(d) $CaCO_3$
Answer: (a)
Solution: Hydroxyapatite $3Ca_3(PO_4)_2.Ca(OH)_2$ is the compound present in the enamel on the surface of the teeth

Question: The number of properties on which the standard reduction electrode potential of halogens depends is:
a) Electron gain enthalpy
b) Sublimation energy
c) Dissociation enthalpy
d) Hydration energy
Answer: 3.00
Solution: Standard reduction electrode potentials of halogens are dependent on the parameters indicated below

$$\frac{1}{2}X_2(g) \xrightarrow{\frac{1}{2}\Delta_{diss}H^{\Theta}} X(g) \xrightarrow{\Delta_{eg}H^{\Theta}} X^-(g) \xrightarrow{\Delta_{hyd}H^{\Theta}} X^-(aq)$$

Question: Number of compounds which have greater freezing point than 0.1 M ethanol (Assume molarity = molality)

a) 0.1 M Na_2SO_4
b) 0.1 M $Ba_3(PO_4)_2$
c) 0.1 M HCl
d) 0.1 M NaOH
Answer: 0.00
Solution: $\Delta T_f = i\ K_f\ m$
Since all solutions have the same concentration, ΔT_f will depend only on i.
i values are as follows:
Ethanol = 1
Na_2SO_4 = 3
$Ba_3(PO_4)2$ = 5
HCl = 2
NaOH = 2
Thus, all the given solutions will have more depression in freezing point than ethanol, i.e., they will have lesser freezing point than 0.1 M ethanol.