

JEE Main 2020 Paper



Date : 3rd September 2020

Time : 09 : 00 am - 12 : 00 pm

Subject : Chemistry

1. It is true that :

- (1) A second order reaction is always a multistep reaction
- (2) A first order reaction is always a single step reaction
- (3) A zero order reaction is a multistep reaction
- (4) A zero order reaction is a single step reaction

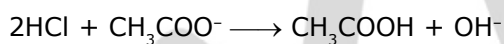
Sol. 3

Factual

2. An acidic buffer is obtained on mixing :

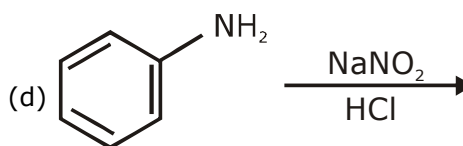
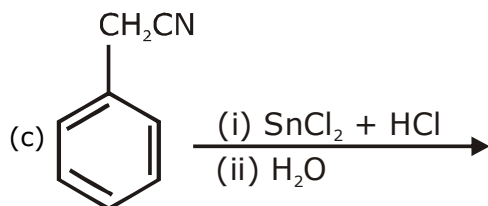
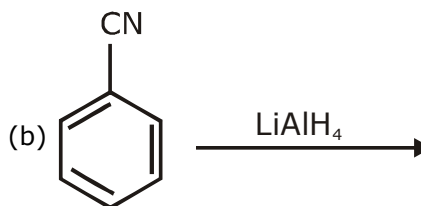
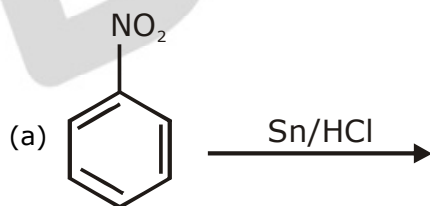
- (1) 100 mL of 0.1 M HCl and 200 mL of 0.1 M CH₃COONa
- (2) 100 mL of 0.1 M HCl and 200 mL of 0.1 M NaCl
- (3) 100 mL of 0.1 M CH₃COOH and 100 mL of 0.1 M NaOH
- (4) 100 mL of 0.1 M CH₃COOH and 200 mL of 0.1 M NaOH

Sol. 1



Acidic buffer

3. The Kjeldahl method of Nitrogen estimation fails for which of the following reaction products?



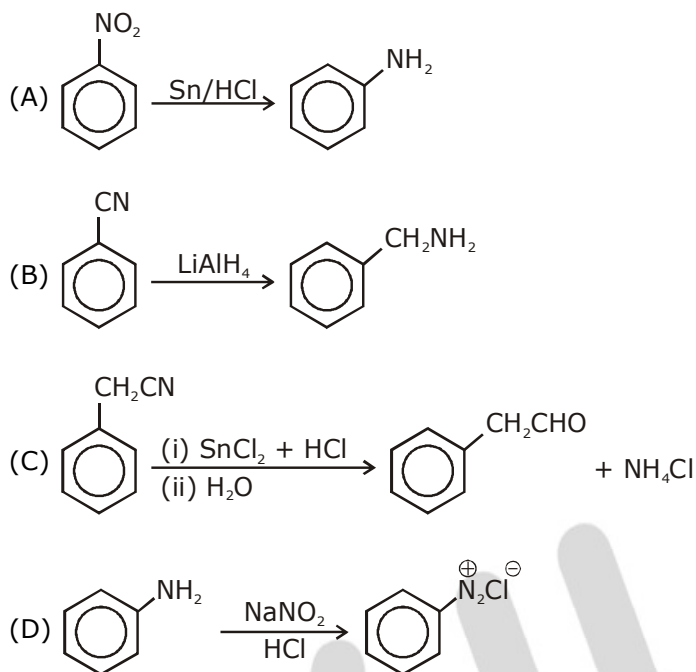
- (1) (a), (c) and (d)
- (3) (c) and (d)

- (2) (b) and (c)
- (4) (a) and (d)

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Sol. 3



Diazo compound and inorganic nitrogen can't be estimated by kjeldal method.

4. If the boiling point of H_2O is 373 K, the boiling point of H_2S will be :
- (1) greater than 300 K but less than 373 K
 - (2) equal to 373 K
 - (3) more than 373 K
 - (4) less than 300 K

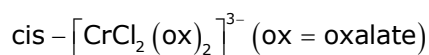
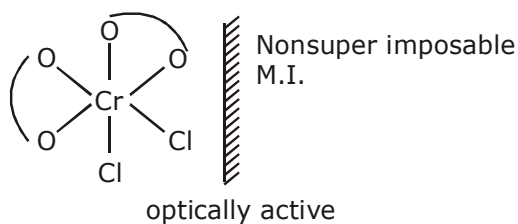
Sol. 4

Less than 300 K (factual)

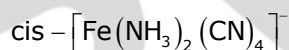
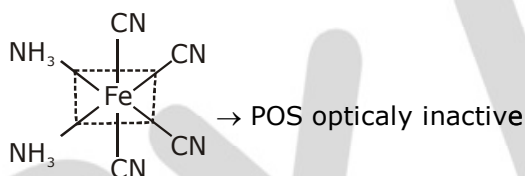
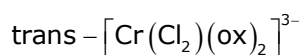
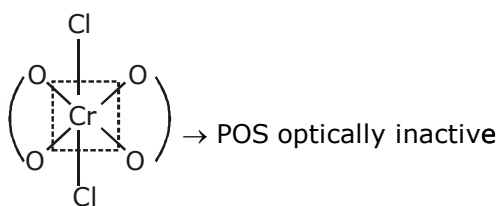
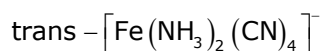
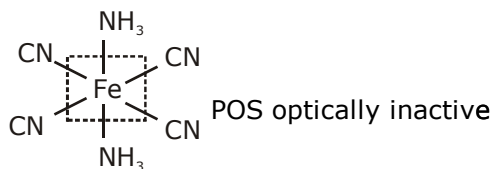
5. The complex that can show optical activity is :

- (1) $\text{cis} - [\text{CrCl}_2(\text{ox})_2]^{3-}$ (ox = oxalate)
- (2) $\text{trans} - [\text{Fe}(\text{NH}_3)_2(\text{CN})_4]^-$
- (3) $\text{trans} - [\text{Cr}(\text{Cl}_2)(\text{ox})_2]^{3-}$
- (4) $\text{cis} - [\text{Fe}(\text{NH}_3)_2(\text{CN})_4]^-$

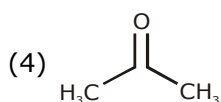
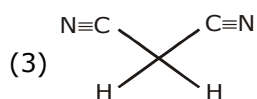
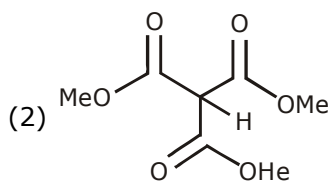
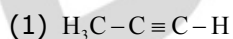
Sol. 1



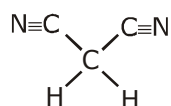
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6. Which one of the following compounds possesses the most acidic hydrogen?

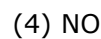
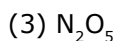
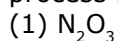


Sol. 3



has most acidic hydrogen among given compound, this is due to strong -M effect of -CN group which stabilize -ve charge significantly.

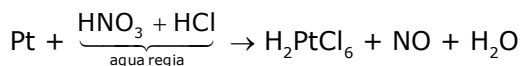
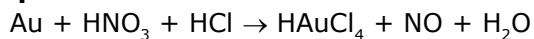
7. Aqua regia is used for dissolving noble metals (Au, Pt, etc.). The gas evolved in this process is :



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Sol. 4

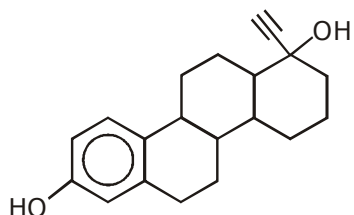


8. The antifertility drug "Novestrol" can react with :

- (1) Br_2/water ; ZnCl_2/HCl ; FeCl_3 (2) Br_2/water ; ZnCl_2/HCl ; NaOCl
 (3) Alcoholic HCN ; NaOCl ; ZnCl_2/HCl (4) ZnCl_2/HCl ; FeCl_3 ; Alcoholic HCN

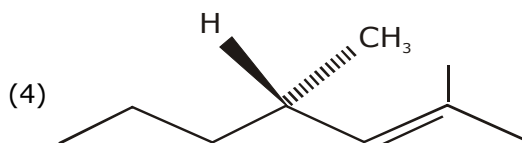
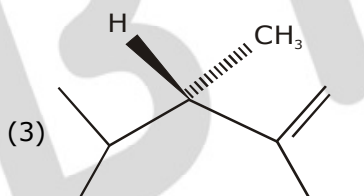
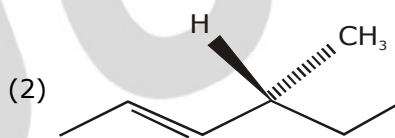
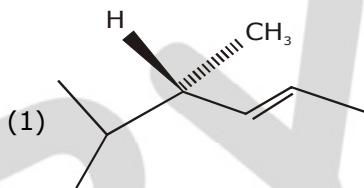
Sol. 1

Novestrol

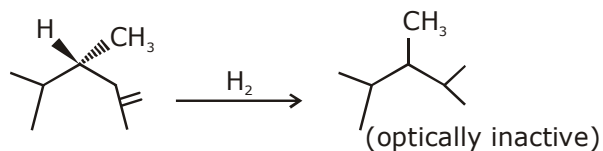


It can react with Br_2/water due to presence of unsaturation, with ZnCl_2/HCl due to $-\text{OH}$ group and with FeCl_3 due to phenol.

9. Which of the following compounds produces an optically inactive compound on hydrogenation?



Sol. 3



10. Of the species, NO , NO^+ , NO^{2+} and NO^- , the one with minimum bond strength is :
 (1) NO^- (2) NO^+ (3) NO^{2+} (4) NO

Sol. 1

$$\text{B.O. NO}^- = 2$$

$$\text{B.O. NO}^+ = 3$$

$$\text{B.O. NO}^{2+} = 2.5$$

$$\text{B.O. NO} = 2.5$$

$$\text{B.O.} \propto \frac{1}{\text{B.L}}$$

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- 11.** Glycerol is separated in soap industries by :
- | | |
|-----------------------------|---|
| (1) Fractional distillation | (2) Distillation under reduced pressure |
| (3) Differential extraction | (4) Steam distillation |

Sol. 2

conceptual

Glycerol is separated in soap industries by distillation under reduced pressure

- 12.** Thermal power plants can lead to :
- | | |
|---------------------------|------------------------|
| (1) Ozone layer depletion | (2) Blue baby syndrome |
| (3) Eutrophication | (4) Acid rain |

Sol. 4

Refer environmental chemistry

It emits CO_2 that combine with moisture of atmosphere and forms H_2CO_3 (carbonic acid)

- 13.** Henry's constant (in kbar) for four gases α , β , γ and δ in water at 298 K is given below:

	α	β	γ	δ
K_H	50	2	2×10^{-5}	0.5

(density of water = 10^3 kg m^{-3} at 298 K)

This table implies that :

- (1) solubility of γ at 308 K is lower than at 298 K
- (2) The pressure of a 55.5 molal solution of δ is 250 bar
- (3) α has the highest solubility in water at a given pressure
- (4) The pressure of a 55.5 molal solution of γ is 1 bar

Sol. 1

$p = K_H X$ mol fraction of gas in liquid.

On increasing temp, ' K_H ' increases

Hence solubility $\downarrow$

therefore, option 1

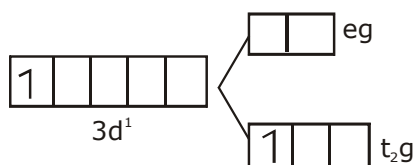
- 14.** The electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ shows a single broad peak with a maximum at $20,300 \text{ cm}^{-1}$. The crystal field stabilization energy (CFSE) of the complex ion, in kJ mol^{-1} , is :

(1 $\text{kJ mol}^{-1} = 83.7 \text{ cm}^{-1}$)

- | | | | |
|----------|-----------|-----------|--------|
| (1) 83.7 | (2) 242.5 | (3) 145.5 | (4) 97 |
|----------|-----------|-----------|--------|

Sol. 4

$[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ Ti^{3+} $3d^1$ in octahedral field of ligand



$$\text{CFSE} = -0.4 \Delta_0$$

$$\text{CFSE} = \frac{-0.4 \times 20300}{83.7}$$

$$= 97 \text{ kJ mol}^{-1}$$

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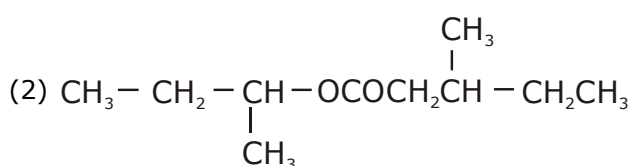
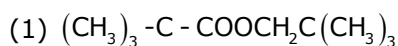
15. The atomic number of the element unnilennium is :

- (1) 109 (2) 102 (3) 119 (4) 108

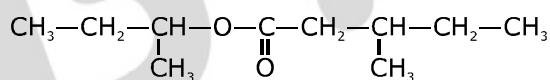
Sol. 1

Unnilennium 109

16. An organic compound [A], molecular formula $C_{10}H_{20}O_2$ was hydrolyzed with dilute sulphuric acid to give a carboxylic acid [B] and an alcohol [C]. Oxidation of [C] with $CrO_3 - H_2SO_4$ produced [B]. Which of the following structures are not possible for [A]?

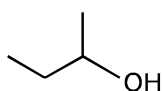


Sol. 2



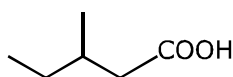
(A)

$\xrightarrow{H_2O/H^+}$



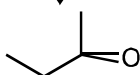
(C)

+



(B)

$\xrightarrow{CrO_3-H_2SO_4}$

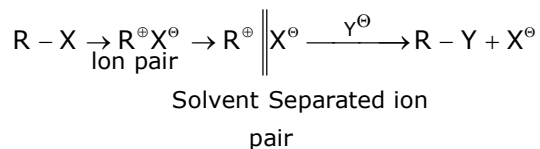


($\neq$ B)

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17. The mechanism of S_N1 reaction is given as :



A student writes general characteristics based on the given mechanism as :

- (a) The reaction is favoured by weak nucleophiles.
- (b) $R^{\oplus}$ would be easily formed if the substituents are bulky.
- (c) The reaction is accompanied by racemization.
- (d) The reaction is favoured by non-polar solvents.

Which observations are correct?

- (1) (a) and (b)
- (2) (a), (b) and (c)
- (3) (a) and (c)
- (4) (b) and (d)

Sol. 2

Statement (a), (b) & (c) are correct for S_N1 reaction mechanism.

18. Tyndall effect is observed when:

- (1) The diameter of dispersed particles is much smaller than the wavelength of light used.
- (2) The diameter of dispersed particles is much larger than the wavelength of light used.
- (3) The refractive index of dispersed phase is greater than that of the dispersion medium.
- (4) The diameter of dispersed particles is similar to the wavelength of light used.

Sol. 4

Diameter of dispersed particles should not be much smaller than wavelength of light used.

Refer topic surface chemistry

19. Let C_{NaCl} and C_{BaSO_4} be the conductances (in S) measured for saturated aqueous solutions of NaCl and $BaSO_4$, respectively, at a temperature T. Which of the following is false?

- (1) $C_{NaCl}(T_2) > C_{NaCl}(T_1)$ for $T_2 > T_1$
- (2) $C_{BaSO_4}(T_2) > C_{BaSO_4}(T_1)$ for $T_2 > T_1$
- (3) Ionic mobilities of ions from both salts increase with T.
- (4) $C_{NaCl} \gg C_{BaSO_4}$ at a given T

Sol. 4

Ionic

$C_{NaCl} \gg C_{BaSO_4}$ at temp 'T'

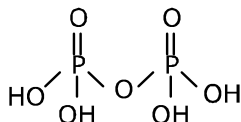
20. In a molecule of pyrophosphoric acid, the number of P-OH, P = O and P - O - P bonds/moiety(ies) respectively are :

- (1) 3, 3 and 3
- (2) 4, 2 and 1
- (3) 2, 4 and 1
- (4) 4, 2 and 0

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Sol. 2



P – OH bonds = 4

P = O bonds = 2

P – O – P linkage = 1

Ans. 4, 2, 1

- 21.** The mole fraction of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) in an aqueous binary solution is 0.1. The mass percentage of water in it, to the nearest integer, is _____.

Sol. 47 %

$$x_{\text{Glucose}} = 0.1$$

$$\text{mass\% of glucose} = \frac{0.1 \times 180}{0.1 \times 180 + 0.9 \times 18} \times 100$$

$$= \frac{1800}{18 + 16.2}$$

$$= \frac{1800}{34.2} \%$$

$$= 52.63\%$$

$$= 53\%$$

$$\therefore \text{mass \% of H}_2\text{O} = 47\%$$

- 22.** The volume strength of 8.9 M H_2O_2 solution calculated at 273 K and 1 atm is _____. (R = 0.0821 L atm K⁻¹ mol⁻¹) (rounded off to the nearest integer)

Sol. 100

$$\text{Vol. strength} = \frac{8.9}{2} \times \frac{0.821 \times 273}{1}$$

$$= 99.73$$

$$= 100$$

- 23.** An element with molar mass 2.7×10^{-2} kg mol⁻¹ forms a cubic unit cell with edge length 405 pm. If its density is 2.7×10^3 kg m⁻³, the radius of the element is approximately _____ $\times 10^{-12}$ m (to the nearest integer).

Sol. 143

$$\text{Density} = \frac{Z \times \text{GMM}}{N_A \times a^3}$$

$$2.7 \times 10^3 = \frac{Z \times 2.7 \times 10^{-2}}{6.023 \times 10^{23} \times (405 \times 10^{-12})^3}$$

$$Z = 6.023 \times 405 \times 405 \times 405 \times 10^{23-36+3+2}$$

$$Z = 6.023 \times 405 \times 405 \times 405 \times 10^{-8}$$

$$Z = 4$$

FCC

$$4R = \sqrt{2} \times a$$

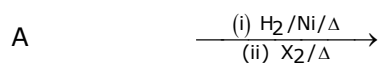
$$R = \frac{405}{2\sqrt{2}} \times 10^{-12} = 143.21 \times 10^{-12} \text{m}$$

$$= 143 \text{ ans}$$

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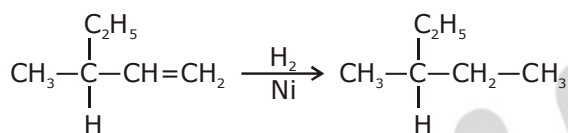


24. The total number of monohalogenated organic products in the following (including stereoisomers) reaction is _____.

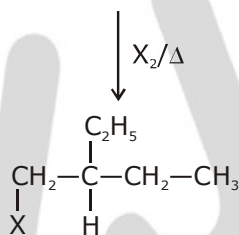


(Simplest
optically
active
alkene)

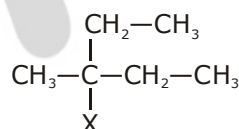
Sol. 8



(Simplest optically
active alkene)

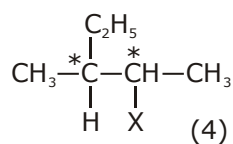


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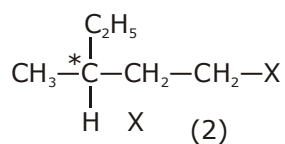


+

Total 8 organic
products are
possible



+



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- 25.** The photoelectric current from Na (Work function, $w_0 = 2.3 \text{ eV}$) is stopped by the output voltage of the cell $\text{Pt(s)} \mid \text{H}_2(\text{g}, 1 \text{ Bar}) \mid \text{HCl (aq. pH} = 1) \mid \text{AgCl(s)} \parallel \text{Ag(s)}$.

The pH of aq. HCl required to stop the photoelectric current from K ($w_0 = 2.25 \text{ eV}$), all other conditions remaining the same, is _____ $\times 10^{-2}$ (to the nearest integer).
Given,

$$2.303 \frac{RT}{F} = 0.06 \text{ V}; E_{\text{AgCl} \mid \text{Ag} \mid \text{Cl}^-}^0 = 0.22 \text{ V}$$

Sol. 58

Energy of photon = $2.3 - E_{\text{cell}}$ {for Na}

Energy of photon = $2.25 - E_{\text{cell}}$ {for K}

E_{cell} {for 'Na'} + 0.05 = E_{cell} {for 'K'}

$$0.22 + 0.06 \log [\text{H}^+][\text{Cl}^-] + 0.05 = 0.22 + 0.06 \log [\text{H}^+][\text{Cl}^-]$$

$$6 \log (10^{-2}) + 5 = 6 \log [\text{H}^+][\text{Cl}^-]$$

$$\log (10^{-12}) + \log (10^5) = \log \{[\text{H}^+][\text{Cl}^-]\}^6$$

$$\{[\text{H}^+][\text{Cl}^-]\}^6 = 10^{-7}$$

$$[\text{H}^+]^{12} = 10^{-7}$$

$$\text{pH} = \frac{7}{12} = 0.58$$

$$= 58 \times 10^{-2} = 58 \text{ Ans}$$