CHEMISTRY
09 Jan. 2019 [Session : 09.30 AM to 12.00 PM]
JEE MAIN PAPER ONLINE
RED COLOUR CONSIDER OFFICIAL ANSWER

1. Correct statements among a to d regarding silicones are:

(a) They are polymes with hydrophobic character.

(b) They are biocompatible.

(c) In general, they have high thermal stability and low dielectric strength.

(d) Usually, they are resistant to oxidation and used as greases.

(1) (a), (b) and (c) only (2) (a), (b) and (d) only

(3) (a) and (b) only (4) (a) , (b), (c) and (d)

a से d में से सिलिकॉन के संबंध में सही कथन हैं:

(a) ये बहुलक जल–विरागी प्रकृति के होते हैं।

(b) इनकी जैवसंगतिता होती है।

(c) साधारणतया, इनका उच्च ऊष्मा स्थायित्व तथा निम्न परावैद्युत सामर्थ्य होता है।

(d) सामान्यतया, ये ऑक्सीकरण प्रतिरोधी होते हैं तथा ग्रीज की तरह उपयोग में लाये जाते हैं।

(1) केवल (a), (b) तथा (c) (2) केवल (a), (b) तथा (d)

(3) केवल (a) तथा (b) (4) (a), (b), (c) तथा (d)

A. 2

Question ID : 41652910092

Option 1 ID : 41652939826

Option 2 ID : 41652939829

Option 3 ID : 41652939828

Option 4 ID : 41652939827

sol. Silicones are polymer with Si–O–Si linkages and are strongly hydrophobic. They are highly thermally stable with high dielectric strength. Nowadays silicone are commony used as greases.

2. For emission line fo atomic hydrogen from $n_i = 8$ to $n_f = n$, the plot of wave number $(\bar{\nu})$ against $\left(\frac{1}{n^2}\right)$ will be (The Rydbeg constant R_H is in wave numbe unit)

(1) Linear with slope $-R_H$ (2) Linear with slope R_H

(3) Linear with intecept $-R_H$ (4) Non linear

परमाणु हाइड्रोजन के $n_i = 8$ से $n_f = n$ तक की उत्सर्जन लाइन के लिए $\left(\frac{1}{n^2}\right)$ के विरूद्ध तरंग संख्या $(\bar{\nu})$ का प्लाट होगा, (रिडबर्ग स्थिरांक, R_H तरंग संख्या के मात्रक में)

(1) $-R_H$ स्लोप के साथ रैखिक (2) R_H स्लोप के साथ रैखिक

(3) $-R_H$ अन्तः खण्ड के साथ रैखिक (4) अरैखिक

A. 2

Question ID : 41652910098

Option 1 ID : 41652939851

Option 2 ID : 41652939853

Option 3 ID : 41652939850

Option 4 ID : 41652939852

sol. $\overline{v} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)z^2 (z = 1)$

$\overline{v} = R_H\left(\frac{1}{n^2} - \frac{1}{8^2}\right)$

$\overline{v} = \frac{R_H}{n^2} - \frac{R_H}{64}$

$y = mx + c$

$x = \frac{1}{n^2}, m = R_H (\text{slope})$

3. Which one of the following statements regarding Henry's law is not correct?

(1) The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution

(2) The value of K_H increases with increase of temperature and K_H is function of the nature of the gas

(3) Different gases have different K_H (Henry's law constant) values at the same temperature

(4) Higher the value of K_H at a given pressure, higher is the solubility of the gas in the liquids.

हेनरी नियम के संबंध में निम्नलिखित कथनों में से कौन सा एक सही नहीं है?

(1) वाष्प प्रावस्था में गैस का आंशिक दाब विलयन में गैस के मोलांश के समानुपाती होता है।

(2) K_H का मान ताप के बढ़ने पर बढ़ता है तथा K_H गैस की प्रकृति का फलन है।

(3) एक ही ताप पर, विभिन्न गैसों के K_H (हेनरी नियम स्थिरांक) भिन्न होते हैं।

(4) एक दिये गये दाब पर, द्रव में गैस की विलेयता अधिक होने पर K_H का मान अधिक होता है।

A. 4

Question ID : 41652910101

Option 1 ID : 41652939862

Option 2 ID : 41652939865

Option 3 ID : 41652939863

Sol. According to Henry's Law

$P_{gas} = K_H X_{gas}$

Solubility decreases with the increase in value of K_H.

Option 4 ID : 41652939864

4. The ore that contains both iron and copper is:

(1) Malachite (2) Dolomite (3) Coppe pyrites (4) Azurite

आयरन तथा कॉपर दोनों जिस अयस्क में उपस्थित हैं

(1) मैलेकाइट (2) डोलोमाइट (3) कॉपर पाइराइट (4) ऐजुराइट

A. 3

Question ID : 41652910087

Option 1 ID : 41652939806

Option 2 ID : 41652939808

Option 3 ID : 41652939809

Option 4 ID : 41652939807

Sol. Copper pyrites $CuFeS_2$

Dolomite $MgCO_3.CaCO_3$

Malachite $CuCO_3.Cu(OH)_2$

Azurite $2CuCO_3.Cu(OH)_2$

Copper pyrites contains both copper and iron

5. The anodic half-cell of lead-acid battery is recharged using electricity of 0.05 Faraday. The amount of $PbSO_4$ electrolyzed in g during the process is: (Molar mass of $PbSO_4 = 303\ g\ mol^{-1}$)

एक लेड–अम्ल बैटरी के एनोडी अर्द्ध–सेल को 0.05 फैराडे विद्युत का उपयोग करके पुनः आवेशित किया जाता है। इस प्रक्रम में विद्युत अपघटित $PbSO_4$ की मात्रा (g में) है : ($PbSO_4$ का मोलर द्रव्यमान = $303\ g\ mol^{-1}$)

(1) 22.8 (2) 11.4 (3) 7.6 (4) 15.2

A. 3

Question ID : 41652910103

Option 1 ID : 41652939872

Option 2 ID : 41652939873

Option 3 ID : 41652939871

Option 4 ID : 41652939870

sol. During Discharging of lead storage battery, At Anode

$$PbSO_4 \longrightarrow \underset{0.05\ \text{mole}}{Pb^{+4}\ (PbO_2)} + 2e^-$$

$$\text{moles of } PbSO_4 \text{ consumed} = \frac{0.05}{2}$$

$$\text{mass of } PbSO_4 = \frac{0.05}{2} \times 303 = 7.575\ \text{gm}$$

6. In general , the properties that decrease and increase down a group in the periodic table, respectively, are:

(1) Electronegativity and electron gain enthalpy

(2) Electron gain enthalpy and electronegativity

(3) Electronegativity and atomic radius.

(4) Atomic radius and electronegativity

समान्यतः, आवर्त्त सारणी के वर्ग में नीचे जाने पर घटने तथा बढ़ने वाले गुणधर्म क्रमशः हैं :

(1) विद्युत–ऋणात्मक तथा इलेक्ट्रॉन लब्धि एंथैल्पी

(2) इलेक्ट्रॉन लब्धि एंथैल्पी तथा विद्युत ऋणात्मकता

(3) विद्युत–ऋणात्मकता तथा परमाणु त्रिज्या

(4) परमाणु त्रिज्या तथा विद्युत–ऋणात्मकता

A. 3

Question ID : 41652910086

Option 1 ID : 41652939803

Option 2 ID : 41652939805

Option 3 ID : 41652939802

Option 4 ID : 41652939804

sol. Down the group

Electronegativity decrease as size increases

$$EN \propto \frac{1}{size}$$

7. According to molecular orbital theory which of the following is true with respect to Li_2^+ and Li_2^- ?

(1) Both are stable (2) Li_2^+ is stable and Li_2^- is unstable

(3) Li_2^+ is unstable and Li_2^- is stable (4) Both are unstable

आण्विक कक्षक सिद्धान्त के अनुसार Li_2^+ तथा Li_2^- के संबंध में निम्नलिखित में से कौन सत्य है?

(1) दोनों स्थायी हैं (2) Li_2^+ स्थायी है तथा Li_2^- अस्थायी है

(3) Li_2^+ अस्थायी है तथा Li_2^- स्थायी है (4) दोनों अस्थायी हैं

A. 1

Question ID : 41652910099

Option 1 ID : 41652939857

Option 2 ID : 41652939855

Option 3 ID : 41652939856

Option 4 ID : 41652939854

sol. Electronic configurations of Li_2^+ and Li_2^- are

Li^+_2: $\sigma_{1s}^2\sigma_{1s}^{*2}1s^2\sigma_{2s}^1$

Li^-_2: $\sigma_{1s}^2\sigma_{1s}^{*2}\sigma_{2s}^2\sigma_{1s}^{*2}$

Bond order of $Li^+_2 = ½ (3 – 2) = ½$

Bond order of $Li^-_2 = ½ (4 – 3) = ½$

Since both Li^+_2 and Li^-_2 have +ve bond order, both are stable (reference : NCERT)

8. The major product of following reaction is:

निम्नलिखित अभिक्रिया का मुख्य उत्पाद है।

$$R - C \equiv N \xrightarrow[(2)H_2O]{(1)AlH(i-Bu)_2} ?$$

(1) RCH_2NH_2 (2) RCOOH (3) $RCONH_2$ (4) RCHO

A. 4

Question ID : 41652910079

Option 1 ID : 41652939774

Option 2 ID : 41652939776

Option 3 ID : 41652939775

Option 4 ID : 41652939777

sol. $$R - C \equiv N \xrightarrow[(2)H_2O]{(1)AlH(i-Bu)_2} R—CHO$$

$AlH(i – Bu)_2$ is DIBALH which reduces nitriles to aldehydes.

9. The correct match between Item-I and Item-II is:

Item-I (drug)	**Item-II (test)**

A Chloroxylenol	P Carbylamine test
B Norethindrone	Q Sodium hydrogen carbonate test
C Sulphapyridine	R Ferric chloride test
d Peniclillin	S Bayer's test

मदों-I तथा II के मध्य सही सुमेल है :

मद-I (औषधि)	**मद-II (परीक्षण)**
A क्लोरोजइलिनाल	P कार्बिलऐमीन परीक्षण
B नारएथिनड्रान	Q सोडियम हाइड्रोजन कार्बोनेट परीक्षण
C सल्फापिरिडीन	R फेरिक क्लोराइड परीक्षण
d पेनिसिलिन	S बेअर परीक्षण

(1) A → Q; B → P ; C → S ; D → R

(2) A → Q; B → S ; C → P ; D → R

(3) A → R; B → P ; C → S ; D → Q

(4) A → R; B → S ; C → P ; D → Q

A. 4

Question ID : 41652910084

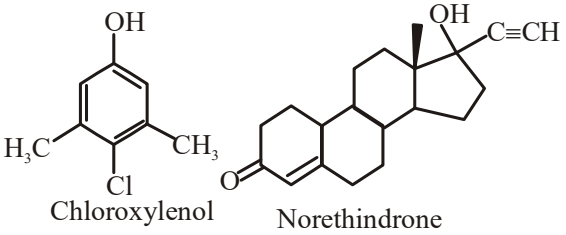
Option 1 ID : 41652939795

Option 2 ID : 41652939796

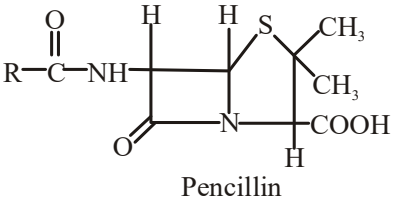
Option 3 ID : 41652939794

Option 4 ID : 41652939797

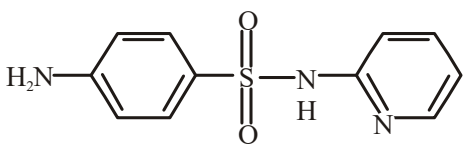
sol. * Chloroxylenol is dettol which contains phenolic group so gives $FeCl_3$ test
* Norethindrone has double bond so will give Baeyer's reagent test
* Sulphapyridine has – NH_2 group, Hence it gives carbyl amine test
* Penicillin has – COOH group so will respond to $NaHCO_3$ test



Chloroxylenol Norethindrone

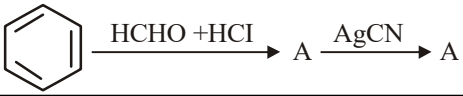


Pencillin



Sulphapyridine

10. The compounds A and B in the following reaction are, respectively:
निम्नलिखित अभिक्रिया में यौगिक A तथा B क्रमशः है :



(1) A = Benzyl alcohol, B = Benzyl isocyanide (2) A = Benzyl chloride, B = Benzyl isocyanide

(3) A = Benzyl alcohol, B = Benzyl cyanide (4) A = Benzyl chloride, B = Benzyl cyanide

(1) A = बेन्जिल ऐल्कोहाल, B = बेन्जिल आइसोसायनाइड

(2) A = बेन्जिल क्लोराइड, B = बेन्जिल आइसोसायनाइड

(3) A = बेन्जिल ऐल्कोहाल, B = बेन्जिल सायनाइड

(4) A = बेन्जिल क्लोराइड, B = बेन्जिल सायनाइड

A. 2

Question ID : 41652910081

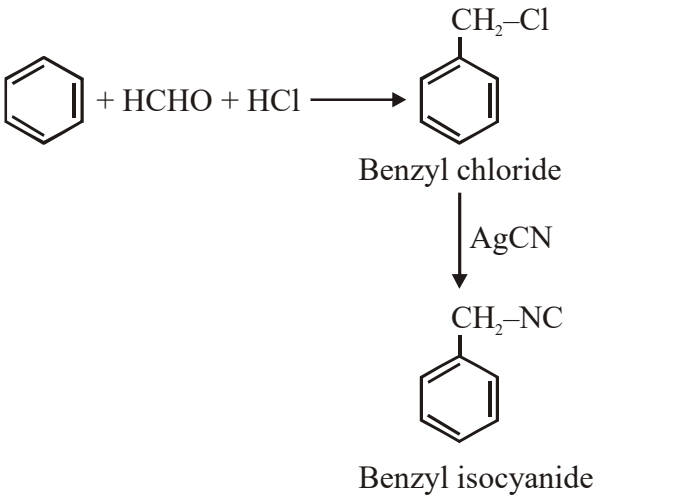
Option 1 ID : 41652939782

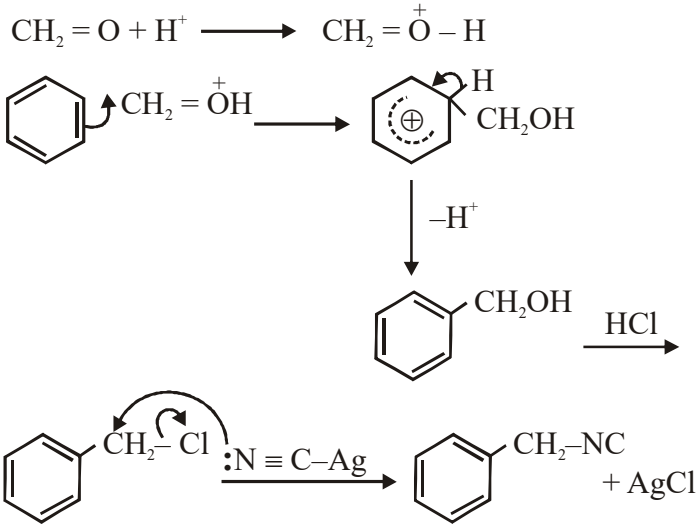
Option 2 ID : 41652939783

Option 3 ID : 41652939785

Option 4 ID : 41652939784

sol.





11. The highest value of the calculated spin only magnetic moment (in BM) among all the transition metal complexes is:

सभी संक्रमण धातु संकुलों में सर्वाधिक परिकलित प्रचक्रण मात्र चुंबकीय आघूर्ण (BM में) है :

(1) 5.92 (2) 6.93 (3) 4.90 (4) 3.87

A. 1

Question ID : 41652910093

Option 1 ID : 41652939830

Option 2 ID : 41652939832

Option 3 ID : 41652939831

Option 4 ID : 41652939833

sol. The transition metal atom/ion in a complex may have unpaired electrons ranging from zero to 5. So, maximum number of unpaired electrons that may be present in a complex is 5. Magnetic moment is given as

$\mu = \sqrt{n(n+2)}$ BM [no. of unpaired electrons = n)

Maximum value of magnetic moment

$= \sqrt{5(5+2)} = \sqrt{35} = 5.92$ BM

12. The increasing order of pKa of the following amino acids in aqueous solution is:
जलीय विलयन में निम्नलिखित ऐमीनों अम्लों के pKa का बढ़ता क्रम है :
Gly Asp Lys Arg

(1) Asp < Gly < Arg < Lys (2) Asp < Gly < Lys < Arg

(3) Gly < Asp < Arg < Lys (4) Arg < Lys < Gly < Asp

A. 2

Question ID : 41652910077

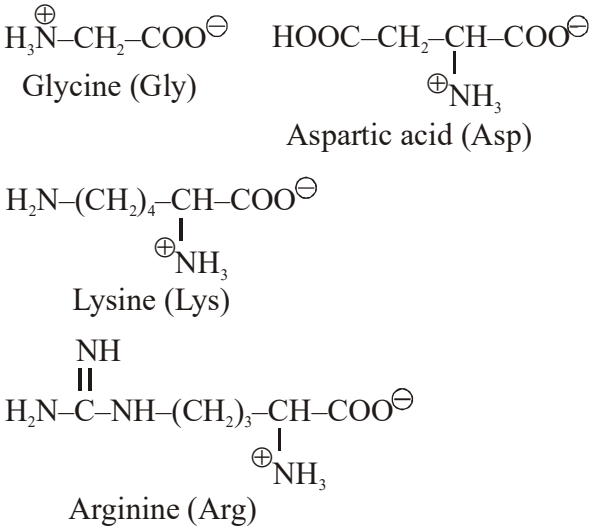
Option 1 ID : 41652939769

Option 2 ID : 41652939767

Option 3 ID : 41652939766

Option 4 ID : 41652939768

Sol. Structures of the given α-amino acids are



Aspartic acid is acidic, glycine is neutral and lysine & arginine are basic α-amino acids with arginine being more basic due to stronger basic functional group. Their pK_a value is directly proportional to basic strength, i.e.,

Arg > Lys > Gly > Asp.

13. Aluminium is usually found in + 3 oxidation state. In contrast, thallium exists in + 1 and + 3 oxidation states. This is due to:

(1) Diagonal relationship (2) Inert pair effect

(3) Lanthanoid contraction (4) Lattice effect

ऐलुमीनियम सामान्यतया + 3 ऑक्सीकरण अवस्था में पाया जाता है। इसके विपरीत, थैलियम + 1 तथा + 3 ऑक्सीकरण अवस्थाओं में रहता है। इसका कारण है :

(1) विकर्ण संबंध (2) अक्रिय युग्म प्रभाव

(3) लैन्थेनॉयड आकुंचन (4) लैटिस प्रभाव

A. 2

Question ID : 41652910091

Option 1 ID : 41652939823

Option 2 ID : 41652939825

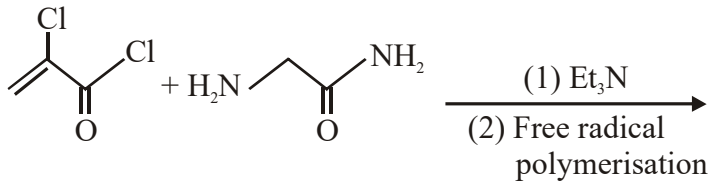
Option 3 ID : 41652939822

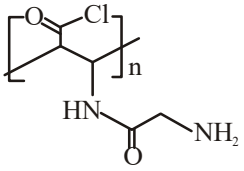
Option 4 ID : 41652939824

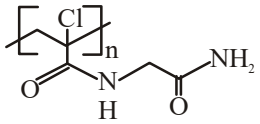
sol. +1 is more stable form of Thallium due to inert pair effect. For Tl +1 > +3 oxidation state.

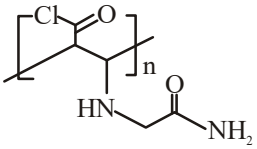
14. Major product of the following reaction is:

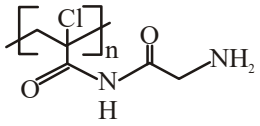
निम्नलिखित अभिक्रिया का मुख्य उत्पाद है :



(1) 

(2) 

(3) 

(4) 

A. 2

Question ID : 41652910076

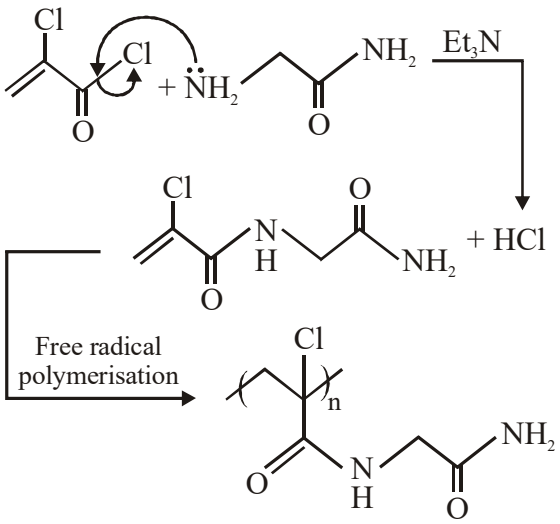
Option 1 ID : 41652939765

Option 2 ID : 41652939763

Option 3 ID : 41652939764

Option 4 ID : 41652939762

sol.



15. Which amongst the following is the strongest acid?
निम्न में से कौन प्रबलतम अम्ल है?

(1) $CHBr_3$ (2) CHI_3 (3) $CH(CN)_3$ (4) $CHCl_3$

A. 3

Question ID : 41652910083

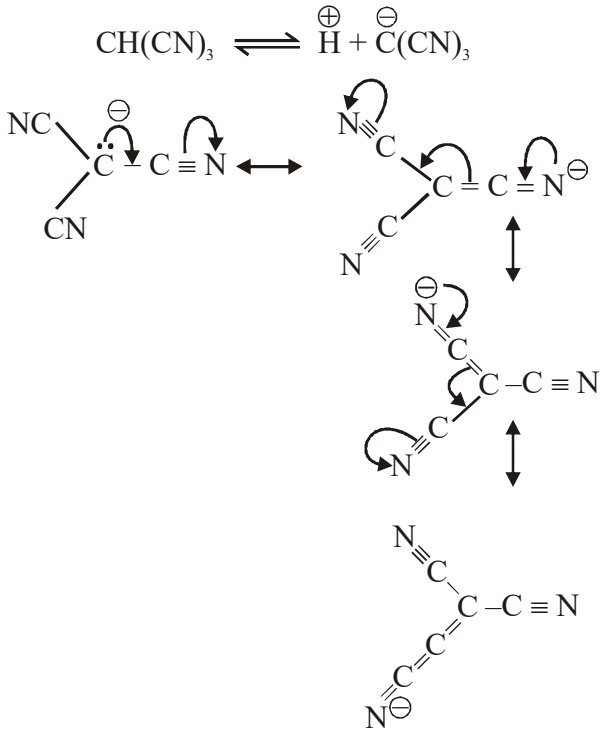
Option 1 ID : 41652939791

Option 2 ID : 41652939792

Option 3 ID : 41652939793

Option 4 ID : 41652939790

sol. Of the given compounds $CH(CN)_3$ is strongest acid because its conjugate base is stabilised by resonance.



$CHBr_3$ and CHI_3 are less stable as their conjugate bases are stabilised by inductive effect of halogens.
Conjugate base of CHCl3 involves back bonding between 2p and 3p orbitals.

16. A solution of sodium sulfate contains 92 g of Na^+ ions per kilogram of water. The molality of Na^+ ions in that solution in mol kg^{-1} is:

सोडियम सल्फेट के एक विलयन में प्रति किलोग्राम जल में 92 g Na^+ आयन हैं। Na^+ आयन की उस विलयन में मोलालिटी (mol kg^{-1} में) होगी :

(1) 16 (2) 12 (3) 8 (4) 4

A. 4

Question ID : 41652910096

Option 1 ID : 41652939845

Option 2 ID : 41652939844

Option 3 ID : 41652939843

Option 4 ID : 41652939842

sol. $92g \text{ of } Na^+ = \frac{92}{23} = 4 \text{ moles}$

$$\text{Molality} = \frac{\text{number of moles}}{\text{mass of solvent(in kg)}}$$

$$= \frac{4}{1} = 4 \text{ mol kg}^{-1}$$

17. The correct decreasing order for acid strength is:

अम्ल सामर्थ्य के लिए सही घटना क्रम है :

(1) $FCH_2COOH > NCCH_2COOH > NO_2CH_2COOH > ClCH_2COOH$

(2) $NO_2CH_2COOH > NCCH_2COOH > FCH_2COOH > ClCH_2COOH$

(3) $NO_2CH_2COOH > FCH_2COOH > CNCH_2COOH > ClCH_2COOH$

(4) $CNCH_2COOH > O_2NCH_2COOH > FCH_2COOH > ClCH_2COOH$

A. 2

Question ID : 41652910080

Option 1 ID : 41652939781

Option 2 ID : 41652939778

Option 3 ID : 41652939780

Option 4 ID : 41652939779

sol. The acidic strength of the given compounds is decided on the basis of (–I) effect of the substituents of carboxylic acids. Higher the (–I) effect of substituent, higher will be the acidic strength. The decreasing order of (–I) effect of the given substituents is $NO_2 > CN > F > Cl$.

Therefore, correct decreasing order of acidic strength

$O_2NCH_2COOH > NCCH_2COOH > FCH_2COOH > ClCH_2COOH$

18. A water sample has ppm level concentration of the following metals Fe = 0.2 ; Mn = 5.0 ; Cu = 3.0 ; Zn = 5.0. The metal that makes the water sample unsuitable for drinking is:

एक जल के प्रतिदर्श में निम्नलिखित धातुओं के ppm सान्द्रता का स्तर है :
Fe = 0.2 ; Mn = 5.0 ; Cu = 3.0 ; Zn = 5.0.
धातु जिसके कारण जल प्रतिदर्श पीने योग्य नहीं है वह है :

(1) Fe (2) Mn (3) Cu (4) Zn

A. 2

Question ID : 41652910095

Option 1 ID : 41652939838

Option 2 ID : 41652939839

Option 3 ID : 41652939840

Option 4 ID : 41652939841

Sol. Prescribed level of Mn is 0.5 ppm. So water sample containing Mn = 5ppm is unsuitable for drinking.

19. 20 mL of 0.1 M H_2SO_4 solution is added to 30 mL of 0.2 M NH_4OH solution. The pH of the resultant mixture is : [pk_b of NH_4OH = 4.7].
20 mL of 0.1 M H_2SO_4 के विलयन को 30 mL 0.2 M NH_4OH के विलय में मिलाने पर प्राप्त मिश्रण के pH का मान है : [pk_b of NH_4OH = 4.7].

(1) 5.2 (2) 5.0 (3) 9.0 (4) 9.4

A. 3

Question ID : 41652910102

Option 1 ID : 41652939867

Option 2 ID : 41652939866

Option 3 ID : 41652939868

Option 4 ID : 41652939869

sol. $H_2SO_4 + 2NH_4OH \rightarrow (NH_4)_2SO_4$

20×0.1 30×0.2

0 2 milimole 2 milimole

Hence resulting solution is a buffer solution

$$p^{OH} = p^{k_b} + \log\frac{[\text{conjugate Acid}]}{[\text{base}]}$$

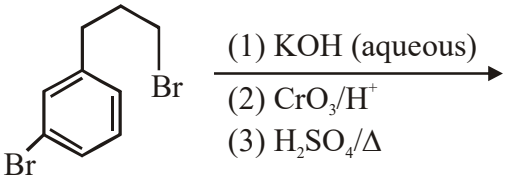
$$p^{OH} = 4.7 + \log\frac{[NH_4^+]}{[NH_4OH]}$$

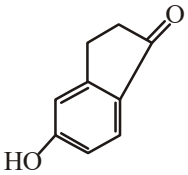
$$p^{OH} = 4.7 + \log\frac{4}{2}$$

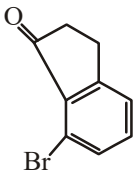
$$p^{OH} = 5$$

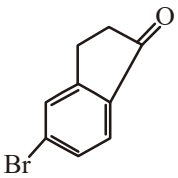
$$p^{H} = 14 - p^{OH} = 9$$

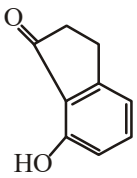
20. The major product of the following reaction is:
निम्नलिखित अभिक्रिया का मुख्य उत्पाद है :



(1) 

(2) 

(3) 

(4) 

A. 3

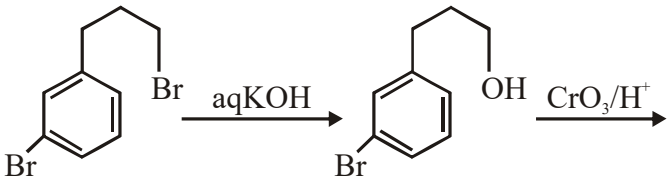
Question ID : 41652910082

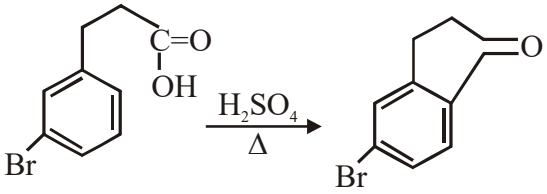
Option 1 ID : 41652939788

Option 2 ID : 41652939787

Option 3 ID : 41652939786

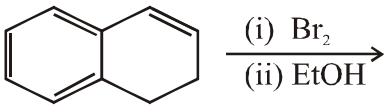
Option 4 ID : 41652939789

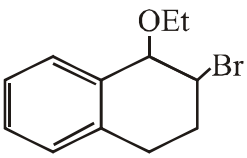
sol. 

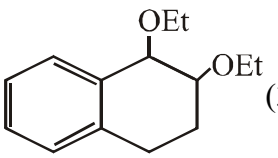


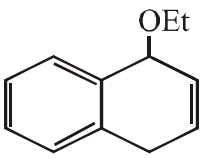
21. The major product of the following reaction is:

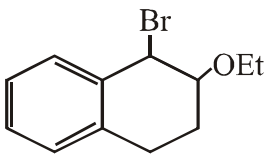
निम्नलिखित अभिक्रिया का मुख्य उत्पाद है :



(1) 

(2) 

(3) 

(4) 

A. 1

Question ID : 41652910085

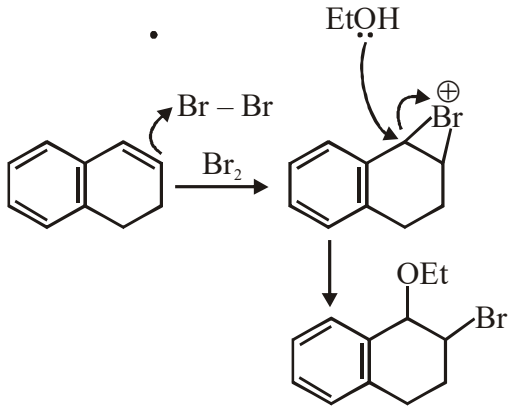
Option 1 ID : 41652939798

Option 2 ID : 41652939800

Option 3 ID : 41652939801

Option 4 ID : 41652939799

sol.



22. 0.5 moles of gas A and *x* moles of gas B exert a presture of 200 Pa in a container of volume 10 m^3 at 1000 K. Given R is the gas constant in JK^{-1} mol^{-1}, x is:

1000 K पर 10m^3 आयतन के एक पात्र में 0.5 mol गैस A तथा *x* mol गैस B, 200 Pa का दाब बनाते हैं। यदि R गैस स्थिरांक ($JK^{-1}mol^{-1}$ में) हो तो x है :

(1) $\frac{2R}{4+R}$ (2) $\frac{4-R}{2R}$ (3) $\frac{4+R}{2R}$ (4) $\frac{2R}{4-R}$

A. 3

Question ID : 41652910097

Option 1 ID : 41652939849

Option 2 ID : 41652939846

Option 3 ID : 41652939847

Option 4 ID : 41652939848

sol. $PV = nRT$ (ideal gas equation)

$200 \times 10 = (0.5 + x)R \times 1000$

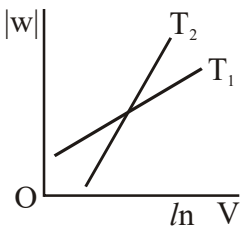
$$0.5 + x = \frac{2}{R}$$

$$x = \frac{2}{R} - \frac{1}{2} \Rightarrow x = \frac{4-R}{2R}$$

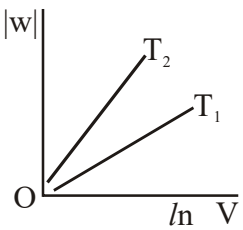
23. Consider the revesible isothermal expansion of an ideal gas in closed system at two different temperatures T_1 and T_2 ($T_1 < T_2$). The correct graphical depiction of the dependence of work done (w) on the final volume (V) is:

दो भिन्न तापों T_1 तथा T_2 ($T_1 < T_2$) पर एक बंद निकाय में एक आदर्श गैस के उत्क्रमणीय समतापी प्रसार पर विचार कीजिए। किये गये कार्य (w) की अंतिम आयतन (V) पर निर्भरता का सही आलेखिक चित्रण है :

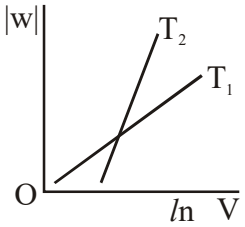
(1)



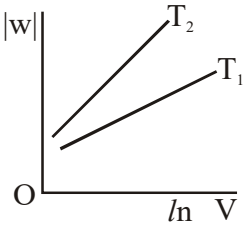
(2)



(3)



(4)



A. 3

Question ID : 41652910100

Option 1 ID : 41652939859

Option 2 ID : 41652939860

Option 3 ID : 41652939861

Option 4 ID : 41652939858

Sol. $w = -nRT\ l\,n\frac{V_2}{V_1}$

$w = -nRT\ l\,n\frac{V_b}{V_i}$

$|w| = nRT\ l\,n\frac{V_b}{V_i}$

$|w| = nRT\,(ln\,V_b - ln\,V_i)$

$|w| = nRT\,ln\,V_b - nRT\,ln\,V_i$

$Y = m\,x - C$

So, slope of curve 2 is more than curve 1 and intersect of curve 2 is more negative then curve 1.

24. The isotopes of hydrogen are:

(1) Protium, deuterium and tritium

(2) Protium and deuterium only

(3) Tritium and protium only

(4) Deuterium and tritium only

हाइड्रोजन के समस्थानिक हैं :

(1) प्रोटियम, ड्यूटीरियम तथा ट्राइटियम

(2) प्रोटियम तथा ड्यूटीरियम मात्र

(3) ट्राइटियम तथा प्रोटियम मात्र

(4) ड्यूटीरियम तथा ट्राइटियम मात्र

A. 1

Question ID : 41652910088

Option 1 ID : 41652939812

Option 2 ID : 41652939810

Option 3 ID : 41652939811

Option 4 ID : 41652939813

sol. Hydrogen has three isotopes :

Protium $_1H^1$

Deuterium $_1H^2$

Tritium $_1H^3$

Their natural abundance is in order H > D > T.

25. Two complexes $[Cr(H_2O)_6]Cl_3$ (A) and $[Cr(NH_3)_6]Cl_3$ (B) are violet and yellow coloured, respectively. The incorrect statement regarding them is:

(1) Both are paramagnetic with three unpaired electrons.

(2) Δ_0 values of (A) and (B) are calculated from the energies of violet and yellow light, respectively.

(3) Both absorb energies corresponding to their complementary colors.

(4) Δ_0 value for (A) is less than that of of (B).

दो संकुल $[Cr(H_2O)_6]Cl_3$ (A) तथा $[Cr(NH_3)_6]Cl_3$ (B) क्रमशः बैगनी तथा पीले रंग के हैं। इनके संबंध में गलत कथन है :

(1) दोनों तीन अयुग्मित इलेक्ट्रॉनों के साथ अनुचुंबकीय है।

(2) (A) तथा (B) के Δ_0 मानों का परिकलन क्रमशः बैंगनी तथा पीले प्रकाश की ऊर्जाओं के द्वारा किया जाता है।

(3) दोनों अपने पूरक रंगों के अनुकूल ऊर्जा का अवशोषण करते हैं।

(4) (A) के लिए Δ_0 का मान (B) की तुलना में कम है।

A. 2

Question ID : 41652910094

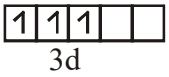
Option 1 ID : 41652939834

Option 2 ID : 41652939837

Option 3 ID : 41652939836

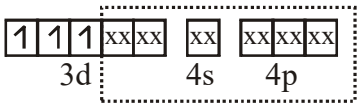
Option 4 ID : 41652939835

sol. Cr^{3+} : $3d^3$



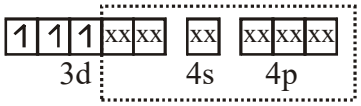
$[Cr(H_2O)_6]^{3+}$:

(A)



d^2sp^3 hybridisation

$[Cr(NH_3)_6]^{3+}$:



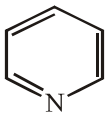
d^2sp^3 hybridisation

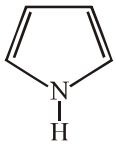
Both (A) and (B) are paramagnetic with 3 unpaired electrons each. The splitting energy (Δ_0) values of (A) and (B) are calculated from the wavelengths of light absorbed and not from the wavelengths of light emitted.

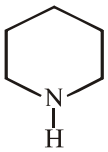
H_2O is a weak field ligand causing lesser splitting than NH_3 which is relatively stronger field ligand.

26. Arrange the following amines in the decreasing order of basicity :

क्षारकता के घटते क्रम में निम्न ऐमीनों को व्यवस्थित कीजिए :


I


II


III

(1) I > III > II (2) III > II > I (3) III > I > II (4) I > II > III

A. 3

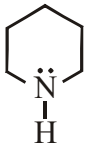
Question ID : 41652910078

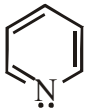
Option 1 ID : 41652939772

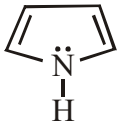
Option 2 ID : 41652939770

Option 3 ID : 41652939771

Option 4 ID : 41652939773

sol.  most basic

 lone pair is not involved in resonance but N atom is sp^2 hybridsed

 lone pair of nitrogen is involved in aromaticity.

27. The following results were obtained during kinetic studies of the reaction :

$2A + B \rightarrow$ Products

निम्नलिखित अभिक्रिया के गतिक अध्ययनों के दौरान निम्नलिखित परिणाम प्राप्त हुए :

$2A + B \rightarrow$ उत्पाद

Experiment	[A] in(mol L^{-1})	[B] in(mol L^{-1})	Initial Rate of reaction (in mol L^{-1} min^{-1})
I	0.10	0.20	6.93×10^{-3}
II	0.10	0.25	6.93×10^{-3}
III	0.20	0.30	1.386×10^{-2}

The time (in minutes) required to consume half of A is:

A के आधे भाग को समाप्त करने के लिए आवश्यक समय (मिनट में) होगा :

(1) 5 (2) 10 (3) 1 (4) 100

A. 1

Question ID : 41652910104

Option 1 ID : 41652939875

Option 2 ID : 41652939877

Option 3 ID : 41652939874

Option 4 ID : 41652939876

Sol. From experiment I and II, it is observed that order of reaction w.r.t. B is zero.

From experiment II and III,

$$\frac{1.386\times10^{-2}}{6.93\times10^{-3}}=\left(\frac{0.2}{0.1}\right)^{\alpha}$$

$\therefore \quad \alpha = 1$

$\text{Rate} = K[A]^1$

$6.93 \times 10^{-3} = K(0.1)$

$K = 6.93 \times 10^{-2}$

For $2A + B \rightarrow$ products

$$2Kt = l\,n\frac{[A]_0}{[A]}$$

$$t_{1/2} = \frac{0.693}{2K}$$

$$= \frac{0.693}{6.93\times10^{-2}\times2}$$

$= 5$

28. The one that is extensively used as a piezoelectric material is:

(1) Tridymite (2) Quartz (3) Amorphous silica (4) Mica

दाब–विद्युत पदार्थ की तरह विस्तीर्ण उपयोग में आने वाला अयस्क है :

(1) ट्राइडाइमाइट (2) क्वार्ट्ज (3) अक्रिस्टलीय सिलिका (4) माइका

A. 2

Question ID : 41652910090

Option 1 ID : 41652939819

Option 2 ID : 41652939818

Option 3 ID : 41652939821

Option 4 ID : 41652939820

Sol. Quartz exhibits piezoelectricity. It is fact based.

29. The alkaline earth metal nitrate that does not crystallise with water molecules, is:

क्षारीय मृदा धातु नाइट्रेट जिसका जल के अणुओं के साथ क्रिस्टलीकरण नहीं होता है, वह है :

(1) $Ca(NO_3)_2$ (2) $Mg(NO_3)_2$ (3) $Sr(NO_3)_2$ (4) $Ba(NO_3)_2$

A. 4

Question ID : 41652910089

Option 1 ID : 41652939815

Option 2 ID : 41652939814

Option 3 ID : 41652939816

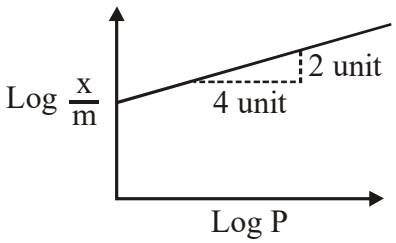
Option 4 ID : 41652939817

sol. Down the group as the charge density decreases so chances of formation of hydrate decreases.

So, $Ba(NO_3)_2$ does not crystallise with water molecules.

30. Adsorption of a gas follows Freundlich adsorption isotherm. In the given plot, *x* is the mass of the gas adsorbed on mass m of the adsorbent at prssure P. $\frac{x}{m}$ is proportional to :

एक गैस का अधिशोषण फ्रॉयन्डलिक अधिशोषण समताप वक्र का अनुसरण करता है। दिये गये प्लाट में, p दाब पर अधिशोषण के m द्रव्यमान पर अवशोषित गैस का द्रव्यमान m है। $\frac{x}{m}$ समानुपातिक है :



(1) $p^{1/2}$ (2) $p^{1/4}$ (3) p (4) p^2

A. 1

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sol. In Freundlich adsorption of a gas on the surface of solid, the extent of adsorption(x/m) is related to pressure of gas (P) as

$$\frac{x}{m} = K(P)^{1/n}$$

$$\text{Or } \log\frac{x}{m} = \log K + \frac{1}{n}\log P$$

$$\text{The slope of plot of } \log\frac{x}{m} \text{ versus } \log P = \frac{2}{4} = \frac{1}{2}$$

$$\therefore \frac{x}{m} \propto (P)^{1/2}$$