

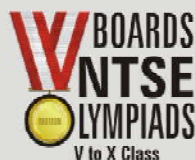
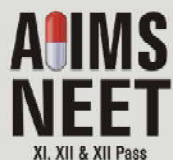
हमारा विश्वास... हर एक विद्यार्थी है स्वास

**JEE
MAIN
JAN
2020**

PAPER WITH SOLUTION

9th January 2020 _ SHIFT - 1

CHEMISTRY



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1. If the magnetic moment of a dioxygen species is 1.73 B.M it may be:

- (1) O_2 or O_2^- (2) O_2 , O_2^- or O_2^+ (3) O_2 or O_2^+ (4) O_2^- or O_2^+

1. एक डाईऑक्साइड स्पीशीज का चुम्बकीय आघूर्ण 1.73 B.M हैं, यह हो सकती है :

- (1) O_2 अथवा O_2^- (2) O_2 , O_2^- अथवा O_2^+ (3) O_2 अथवा O_2^+ (4) O_2^- अथवा O_2^+

Sol. 4

Based on MOT

2. 'X' melts at low temperature and is a bad conductor of electricity in both liquid and solid state, X is:

- (1) Carbon tetrachloride (2) Zinc sulphide
(3) Mercury (4) Silicon carbide

2. 'X' निम्न ताप पर पिघलता है जथा द्रव तथा ठोस दोनों अवस्थाओं में विद्युत का कुचालक है। X है :

- (1) कार्बन टेट्राक्लोराइड (2) जिंक सल्फाइड
(3) मर्करी (4) सिलिकान कार्बाइड

Sol. 1

3. The de Broglie wavelength of an electron in the 4th Bohr orbit is:

- (1) $2\pi a_0$ (2) $8\pi a_0$ (3) $4\pi a_0$ (4) $6\pi a_0$

3. चौथी बोर कक्षा में एक इलेक्ट्रॉन की डी-ब्रोग्ली तरंगदैर्घ्य होगी :

- (1) $2\pi a_0$ (2) $8\pi a_0$ (3) $4\pi a_0$ (4) $6\pi a_0$

Sol. 2

$$\text{De Broglie wavelength } (\lambda) = 2\pi R_0 \times \frac{n}{z}$$

$$= 2\pi R_0 \times \frac{4}{z}$$

$$= \frac{8\pi R_0}{z}$$

Assuming $z = 1$

$$\text{De Broglie wavelength } (\lambda) = 8\pi R_0$$

4. B has a smaller first ionization enthalpy than Be. Consider the following statements:

- (I) it is easier to remove 2p electron than 2s electron
(II) 2p electron of B is more shielded from the nucleus by the inner core of electrons than the 2s electrons of Be
(III) 2s electron has more penetration power than 2p electron
(IV) atomic radius of B is more than Be (atomic number B = 5, Be = 4)

The correct statements are:

- (1) (I), (II) and (III) (2) (I), (III) and (IV)
(3) (II), (III) and (IV) (4) (I), (II) and (IV)

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4. B की प्रथम आयनन एन्थैल्पी Be से कम है। निम्न कथनों पर विचार कीजिए :
- (I) 2s इलेक्ट्रॉनों की तुलना में 2p इलेक्ट्रॉन हटाना आसान है।
 (II) Be के 2s इलेक्ट्रॉनों की तुलना में B के 2p इलेक्ट्रॉन आंतरिक कोर इलेक्ट्रॉनों द्वारा नाभिक से ज्यादा परिरक्षित हैं।
 (III) 2p इलेक्ट्रॉनों की तुलना में 2s इलेक्ट्रॉन की प्रवेशी सामर्थ्य ज्यादा है।
 (IV) B की परमाणु त्रिज्या, Be से ज्यादा है। (परमाणु संख्या B = 5, Be = 4)

सही कथन है :

- (1) (I), (II) तथा (III) (2) (I), (III) तथा (IV)
 (3) (II), (III) तथा (IV) (4) (I), (II) तथा (IV)

Sol. 1

5. The electronic configurations of bivalent europium and trivalent cerium are: (atomic number : Xe = 54, Ce = 58, Eu = 63)

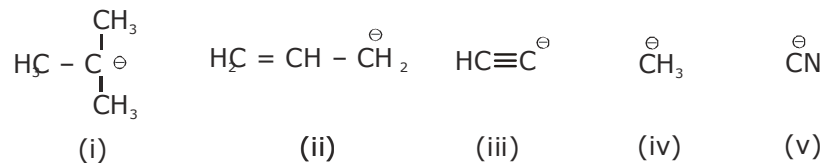
- (1) [Xe] 4f⁴ and [Xe] 4f⁹ (2) [Xe] 4f⁷ 6s² and [Xe] 4f² 6s²
 (3) [Xe] 4f² and [Xe] 4f⁷ (4) [Xe] 4f⁷ and [Xe] 4f¹

5. द्विसंयोजक यूरोपियम तथा त्रिसंयोजक सीरियम के इलेक्ट्रॉनिक विन्साय हैं : (परमाणु संख्या : Xe = 54, Ce = 58, Eu = 63)

- (1) [Xe] 4f⁴ तथा [Xe] 4f⁹ (2) [Xe] 4f⁷ 6s² तथा [Xe] 4f² 6s²
 (3) [Xe] 4f² तथा [Xe] 4f⁷ (4) [Xe] 4f⁷ तथा [Xe] 4f¹

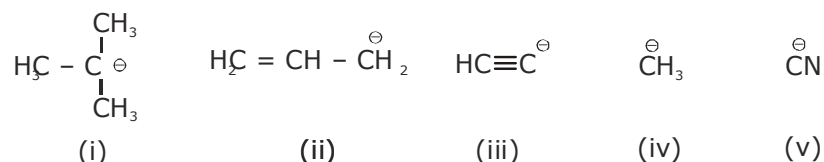
Sol. 4

6. The increasing order of basicity for the following intermediates is (from weak to strong)



- (1) (v) < (iii) < (ii) < (iv) < (i) (2) (v) < (i) < (iv) < (ii) < (iii)
 (3) (iii) < (i) < (ii) < (iv) < (v) (4) (iii) < (iv) < (ii) < (i) < (v)

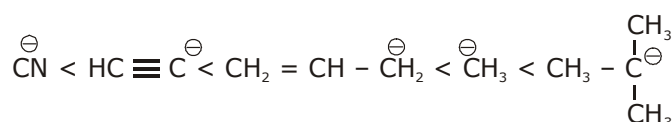
6. निम्न मध्यवर्तियों के लिए क्षारीयता का बढ़ता क्रम है (दुर्बल से प्रबल)



- (1) (v) < (iii) < (ii) < (iv) < (i) (2) (v) < (i) < (iv) < (ii) < (iii)
 (3) (iii) < (i) < (ii) < (iv) < (v) (4) (iii) < (iv) < (ii) < (i) < (v)

Sol. 1

(v) < (iii) < (ii) < (iv) < (i)
 Increasing order of basicity is



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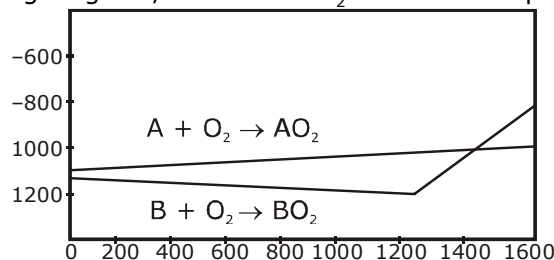
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score 200-240

Fees - ₹ 0
score above 240

7. According to the following diagram, A reduces BO_2 when the temperature is:



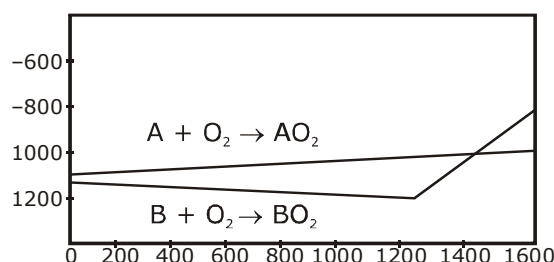
(1) $> 1200^\circ\text{C}$ but $< 1400^\circ\text{C}$

(2) $< 1200^\circ\text{C}$

(3) $< 1400^\circ\text{C}$

(4) $> 1400^\circ\text{C}$

7. निम्न चित्र के अनुसार A, BO_2 का अपचयन करता है जब ताप है :



(1) $> 1200^\circ\text{C}$ परन्तु $< 1400^\circ\text{C}$

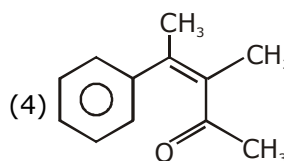
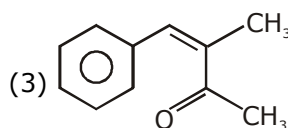
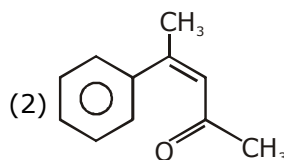
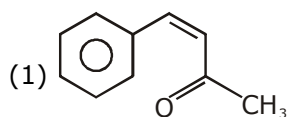
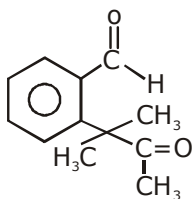
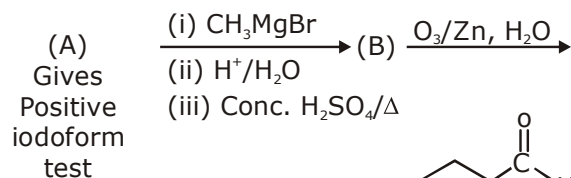
(2) $< 1200^\circ\text{C}$

(3) $< 1400^\circ\text{C}$

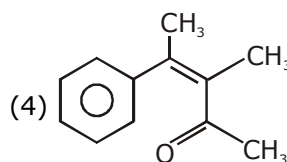
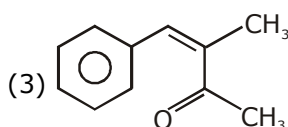
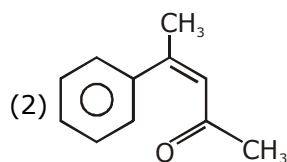
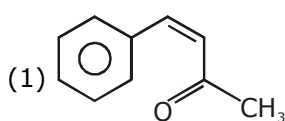
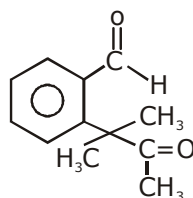
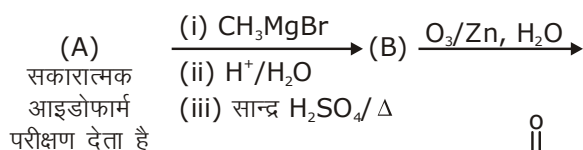
(4) $> 1400^\circ\text{C}$

Sol. 4

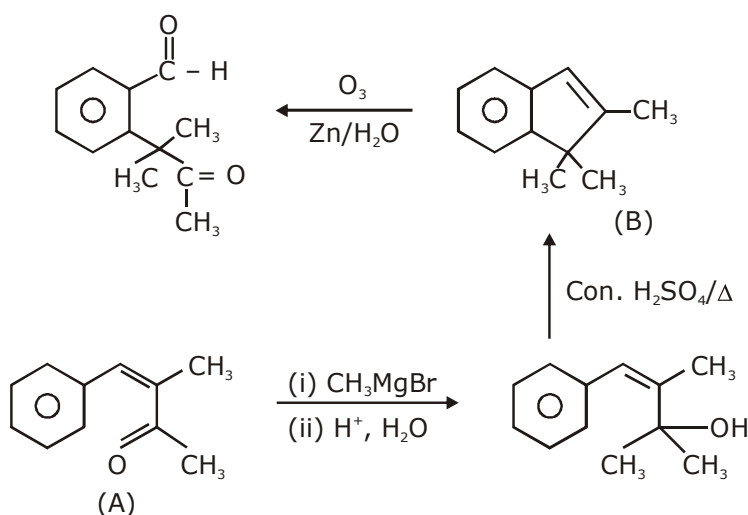
8. Identify (A) in the following reaction sequence:



8. निम्न अभिक्रिया अनुक्रम में (A) की पहचान कीजिए :



Sol. 3



So, the answer should be 3

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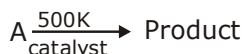
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score 200-240

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score above 240

9. For following reactions



it was found that the E_a is decreased by 30 kJ/mol in the presence of catalyst. If the rate remains unchanged, the activation energy for catalysed reaction is (Assume pre exponential factor is same);

- (1) 75 kJ/mol (2) 135 kJ/mol (3) 198 kJ/mol (4) 105 kJ/mol

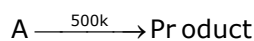
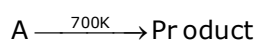
9. निम्न अभिक्रियाओं के लिए



यह पाया जाता है कि उत्प्रेरक की उपस्थिति में E_a , 30 kJ/mol से घट गई। यदि दर अपरिवर्तित रहे तो उत्प्रेरित अभिक्रिया के लिए संक्रियण ऊर्जा होगी (मान लीजिये पूर्व चरघातांकी गुणक वही रहता है) :

- (1) 75 kJ/mol (2) 135 kJ/mol (3) 198 kJ/mol (4) 105 kJ/mol

Sol. 1



$$\frac{E_{a_{\text{cat}}}}{500R} = \frac{E_{a_{\text{cat}}} + 30}{700R}$$

$$7E_{a_{\text{cat}}} = 5E_{a_{\text{cat}}} + 150$$

$$E_{a_{\text{cat}}} = 75 \text{ kJ/mol}$$

10. The acidic, basic and amphoteric oxides, respectively, are:

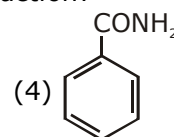
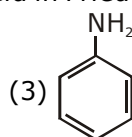
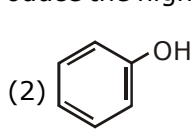
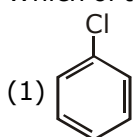
- (1) Cl_2O , CaO , P_4O_{10} (2) Na_2O , SO_3 , Al_2O_3 (3) N_2O_3 , Li_2O , Al_2O_3 (4) MgO , Cl_2O , Al_2O_3

10. अम्लीय, क्षारीय तथा उभयधर्मी ऑक्साइडों क्रमशः हैं :

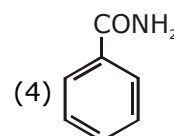
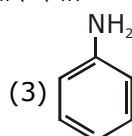
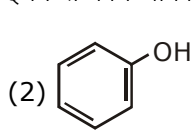
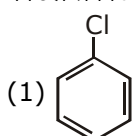
- (1) Cl_2O , CaO , P_4O_{10} (2) Na_2O , SO_3 , Al_2O_3 (3) N_2O_3 , Li_2O , Al_2O_3 (4) MgO , Cl_2O , Al_2O_3

Sol. 3

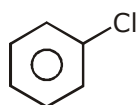
11. Which of these will produce the highest yield in Friedel Crafts reaction?



11. 'फ्रीडल क्राफ्टस अभिक्रिया में इनमें से कौन अधिकतम उत्पाद देगा?



Sol. 1



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12. The compound that cannot act both as oxidising and reducing agent is:

- (1) H_2O_2 (2) HNO_2 (3) H_2SO_3 (4) H_3PO_4

12. वह यौगिक जो उपचायक तथा अपचायक दोनों की तरह कार्य नहीं कर सकता, है :

- (1) H_2O_2 (2) HNO_2 (3) H_2SO_3 (4) H_3PO_4

Sol. 4

H_3PO_4 , oxidation no. of 'P' is +5 which is maximum.
Hence it can act as oxidising agent.

13. If enthalpy of atomisation for $Br_{2(l)}$ is x kJ/mol and bond enthalpy for Br_2 is y kJ/mol, the relation between them:

- (1) is $x = y$ (2) is $x < y$ (3) does not exist (4) is $x > y$

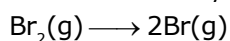
13. यदि $Br_{2(l)}$ के लिए कणन एन्थैल्पी x kJ/mol हो तथा Br_2 के लिए आबन्ध एन्थैल्पी y kJ/mol हो तो उनके बीच सम्बन्ध :

- (1) $x = y$ होगा (2) $x < y$ होगा (3) बनता नहीं है (4) $x > y$ होगा

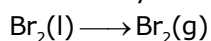
Sol. 4



$$\Delta H = x \text{ kJ/mol} \quad \Delta H = 2x$$



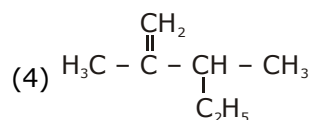
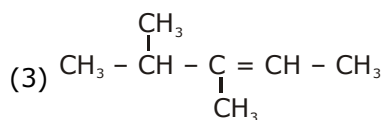
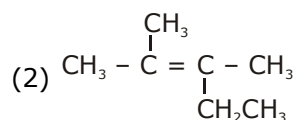
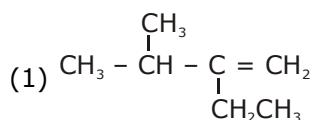
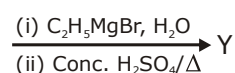
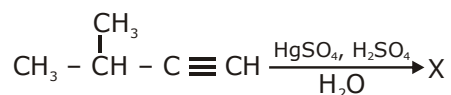
$$\Delta H = y$$



$$\Delta H = [x - y] > 0$$

$$x > y$$

14. The major product (Y) in the following reactions is:



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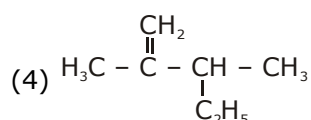
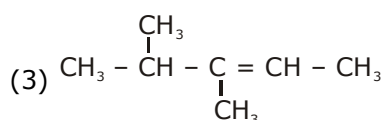
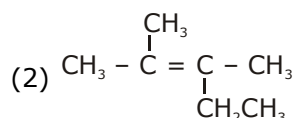
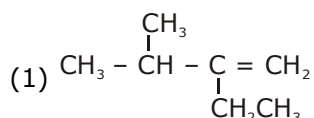
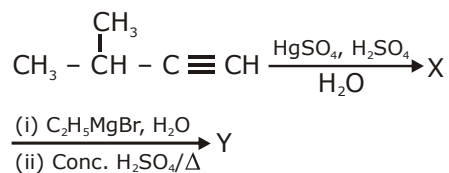
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score 160-200

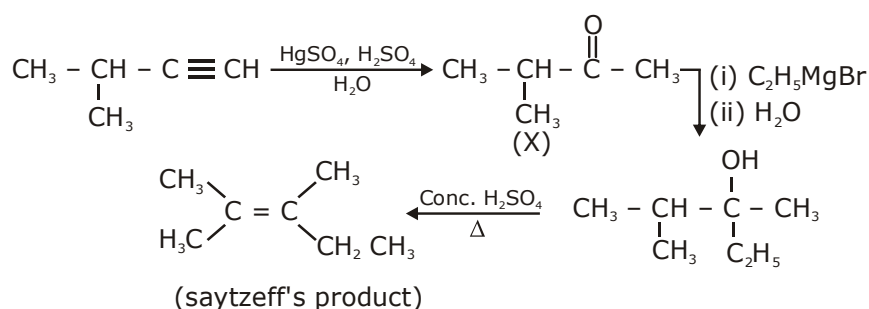
Fees - ₹ 5500
score 200-240

Fees - ₹ 0
score above 240

14. निम्न अभिक्रियाओं में मुख्य उत्पाद (Y) है :

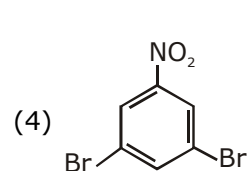
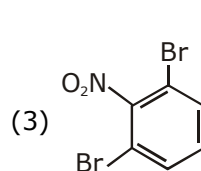
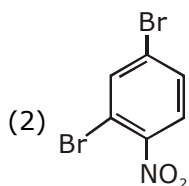
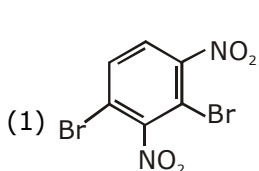
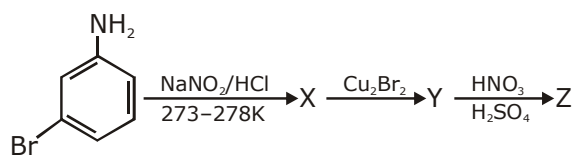


Sol. 2

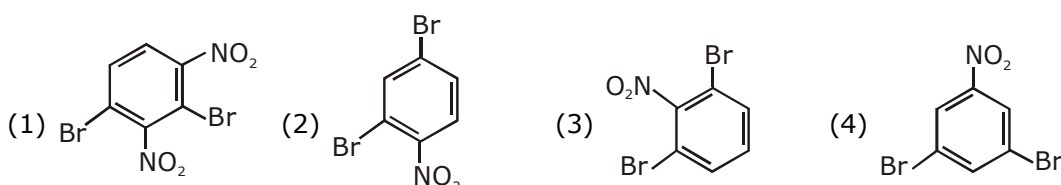
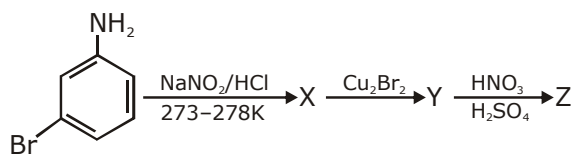


So, the answer is 2

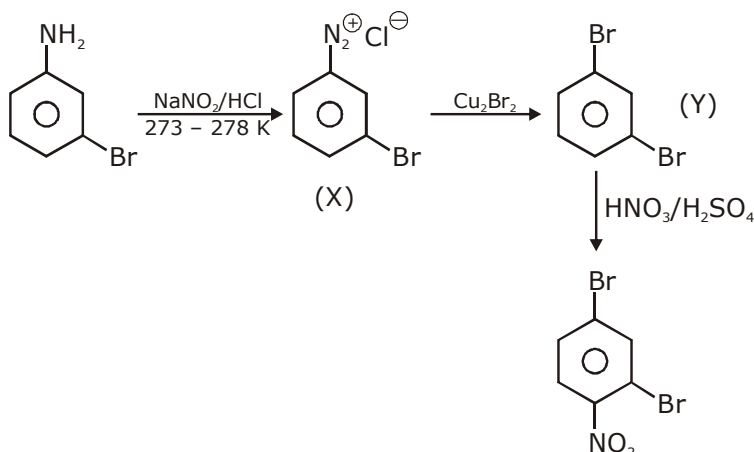
15. The major product Z obtained in the following reaction scheme is:



15. निम्न अभिक्रिया स्कीम में प्राप्त होने वाला मुख्य उत्पाद Z है :



Sol. 2



So, the answer should be 2

16. A chemist has 4 samples of artificial sweetener A, B, C and D. To identify these samples, he performed certain experiments and noted the following observations:

- A and D both form blue-violet colour with ninhydrin.
- Lassaigne extract of C gives positive AgNO_3 test and negative $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ test.
- Lassaigne extract of Band D gives positive sodium nitroprusside test.

Based on these observatgions which option is correct?

- A : Saccharin; B : Alitame; C : Sucralose; D : Aspartame
- A : Aspartame; B : Saccharin; C : Sucralose; D : Alitame
- A : Aspartame; B : Alitame; C : Saccharin; D : Sucralose
- A : Alitame ; B : Saccharin; C : Aspartame; D : Sucralose

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16. एक केमिस्ट के पास कृत्रिम मधुरकों A, B, C तथा D का 4 प्रतिदर्श है। इन प्रतिदर्शों को पहचानने के लिए उसने कुछ प्रयोग किये तथा निम्न प्रेक्षणों को नोट किया :

(i) A तथा D दोनों निनहाइड्रिन के साथ नीला-बैंगनी रंग देते है।

(ii) C का लैसैं सारकत्त AgNO_3 के साथ सकारात्मक तथा $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ के साथ नकारात्मक परीक्षण देता है।

(iii) B तथा D का लैसैं सारकत्त सोडियम नाइट्रोप्रूसाइड के साथ सकारात्मक परीक्षण देता है।

इन प्रेक्षणों के आधार पर कौन सा विकल्प सही हैं ?

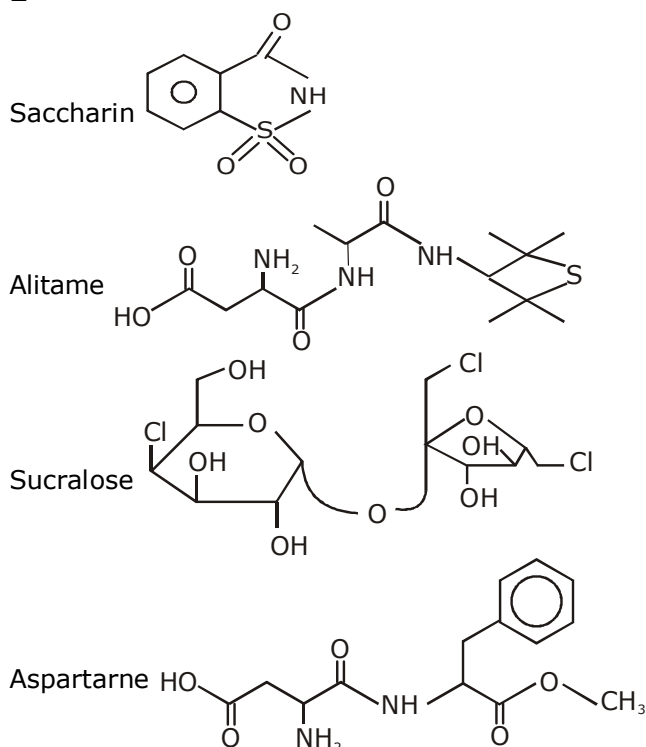
(1) A : सैकरीन; B : ऐलीटेम; C : सुक्रालोज; D : ऐस्परेटेम

(2) A : ऐस्परेटेम; B : सैकरीन; C : सुक्रालोज; D : ऐलीटेम

(3) A : ऐस्परेटेम; B : ऐलीटेम; C : सैकरीन; D : सुक्रालोज

(4) A : ऐलीटेम; B : सैकरीन; C : ऐस्परेटेम; D : सुक्रालोज

Sol. 2



(C) is sucralose because it gives positive test with AgNO_3

(B) is Saccharin because it gives positive test with sodium nitro prusside.

Aspartame and alitame both give blue violet colour with ninhydrin.

So, the answer should be (B).

17. $[\text{Pd}(\text{F})(\text{Cl})(\text{Br})(\text{I})]^{2-}$ has n number of geometrical isomers. Then, the spin-only magnetic moment and crystal field stabilisation energy [CFSE] of $[\text{Fe}(\text{CN})_6]^{n-6}$, respectively, are:

[Note: Ignore the pairing energy]

(1) 2.84 BM and $-1.6 \Delta_0$

(2) 1.73 BM and $-2.0 \Delta_0$

(3) 5.92 BM and 0

(4) 0 BM and $-2.4 \Delta_0$

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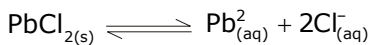
17. $[\text{Pd}(\text{F})(\text{Cl})(\text{Br})(\text{I})]^{2-}$ के ज्यामितीय समावयवों की संख्या n है। तब $[\text{Fe}(\text{CN})_6]^{n-6}$ का स्पिन मात्र चुम्बकीय आघूर्ण तथा क्रिस्टल क्षेत्र स्थायीकरण ऊर्जा [CFSE] क्रमशः हैं :

[नोट : युग्मन ऊर्जा को छोड़ दीजिए]

- (1) 2.84 BM तथा $-1.6 \Delta_0$ (2) 1.73 BM तथा $-2.0 \Delta_0$
(3) 5.92 BM तथा 0 (4) 0 BM तथा $-2.4 \Delta_0$

Sol. 2

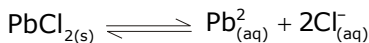
18. The K_{sp} for the following dissociation is 1.6×10^{-5}



Which of the following choices is correct for a mixture of 300 mL 0.134M $\text{Pb}(\text{NO}_3)_2$ and 100 mL 0.4M NaCl?

- (1) Not enough data provided (2) $Q < K_{sp}$
(3) $Q = K_{sp}$ (4) $Q > K_{sp}$

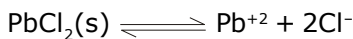
18. निम्न वियोजन के लिए K_{sp} का मान 1.6×10^{-5} है,



0.134M $\text{Pb}(\text{NO}_3)_2$ के 300 mL तथा 0.4M NaCl के 100 mL को मिलाकर बनाये गये मिश्रण के लिए निम्न में से कौन सा विकल्प सही है ?

- (1) पर्याप्त आँकड़ा उपलब्ध नहीं (2) $Q < K_{sp}$
(3) $Q = K_{sp}$ (4) $Q > K_{sp}$

Sol. 4



$$K_{sp} = 1.6 \times 10^{-5}$$

$$[\text{Pb}^{2+}] = 0.134\text{M}, 300 \text{ ml}$$

$$[\text{Cl}^{-}] = 0.4\text{M}, 100\text{ml}$$

$$[\text{Pb}^{2+}]_{\text{Res}} = \frac{0.134 \times 300}{400} = \frac{0.402}{4} = 0.1005$$

$$[\text{Cl}^{-}] = \frac{0.4 \times 100}{400} = 0.1$$

$$Q = [\text{Pb}^{2+}] [\text{Cl}^{-}]^2 = 1005 \times 10^{-6}$$

$$Q > K_{sp}$$

19. Complex X of composition $\text{Cr}(\text{H}_2\text{O})_6\text{Cl}_n$ has a spin only magnetic moment of 3.83 BM. It reacts with AgNO_3 and shows geometrical isomerism. The IUPAC nomenclature of X is:

- (1) Dichloridotetraqua chromium (IV) chloride dihydrate
(2) Tetraaquadichlorido chromium (III) chloride dihydrate
(3) Tetraaquadichlorido chromium (IV) chloride dihydrate
(4) Hexaqua chromium (III) chloride

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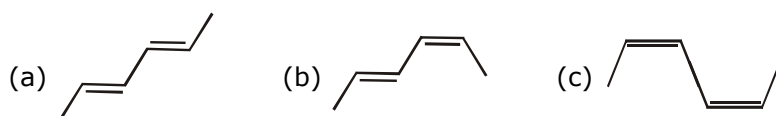
Fees - ₹ 0
score above 240

19. $\text{Cr}(\text{H}_2\text{O})_6\text{Cl}_n$ संघटन के संकुल X का स्पिन मात्र का चुम्बकीय आघूर्ण 3.83 BM है। यह AgNO_3 के साथ अभिक्रिया करता है और ज्यामितीय समावयवता प्रदर्शित करता है। X का आई. यू. पी. ए. सी. नाम है :

- (1) डाइक्लोराइडोटेट्राऐक्वा क्रोमियम(IV) क्लोराइड डाइहाइड्रेट
- (2) टेट्राऐक्वाडाइक्लोराइडो क्रोमियम(III) क्लोराइड डाइहाइड्रेट
- (3) टे ट्राऐक्वाडाइक्लोराइडो क्रोमियम(IV) क्लोराइड डाइहाइड्रेट
- (4) हेक्साऐक्वाक्रोमियम(III) क्लोराइड

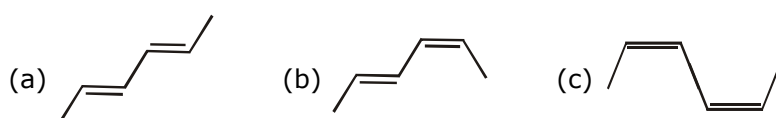
Sol. 7

20. The correct order of heat of combustion for following alkadienes is:



- (1) (a) < (b) < (c) (2) (a) < (c) < (b) (3) (c) < (b) < (a) (4) (b) < (c) < (a)

20. निम्न ऐल्काडाइन्स के लिए दहन ऊष्मा का सही क्रम है :



- (1) (a) < (b) < (c) (2) (a) < (c) < (b) (3) (c) < (b) < (a) (4) (b) < (c) < (a)

Sol. 1

(a) < (b) < (c)

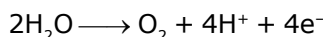
$$\text{Heat of combustion} \propto \frac{1}{\text{Stability of alkene}}$$

(Because no. of carbon are equal)

21. 108 g of silver (molar mass 108 g mol^{-1}) is deposited at cathode from $\text{AgNO}_3(\text{aq})$ solution by a certain quantity of electricity. The volume (in L) of oxygen gas produced at 273 K and 1 bar pressure from water by the same quantity of electricity is _____.

21. एक निश्चित विद्युत मात्रा द्वारा AgNO_3 (जलीय) से 108 g सिलवर (मोलर द्रव्यमान 108 g mol^{-1}) कैथोड पर निक्षेपित किया गया। विद्युत की उसी मात्रा द्वारा 273 K तथा 1 बार दाब पर बनायी गई ऑक्सीजन का आयतन (L में) होगा _____.

Sol. 5.6 lit



Eq. of O_2 = Eq. of Ag

Moles of $\text{O}_2 \times 4$ = moles of Ag $\times 1$

$$\text{Moles of } \text{O}_2 = \frac{1}{4} \text{ mol}$$

$$\text{Volume of } \text{O}_2 \text{ at STP} = \frac{1}{4} \times 22.4 = 5.6 \text{ lit}$$

- 22.** How much amount of NaCl should be added to 600 g of water ($\rho = 1.00 \text{ g/mL}$) to decrease the freezing point of water to $-0.2 \text{ }^\circ\text{C}$? _____ (The freezing point depression constant for water = 2K kg mol^{-1})
- 22.** 600 g पानी ($\rho = 1.00 \text{ g/mL}$) में NaCl की कितनी मात्रा मिलायी जाय कि उसका हिमांक घटकर $-0.2 \text{ }^\circ\text{C}$ हो जाय ? _____ ।
(पानी के लिए हिमांक अवनमन स्थिरांक = 2K kg mol^{-1})

Sol. 1.755

$$\Delta T_f = 0.2 = 2 \times \frac{n}{600} \times 1000 \times 2$$

$$n = 0.1 \times \frac{0.6}{2} = 0.03 \text{ moles}$$

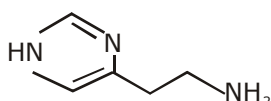
$$\text{Mass of NaCl} = 0.03 \times 58.5 \\ = 1.755$$

- 23.** The mass percentage of nitrogen in histamine is _____.

- 23.** हिस्टैमिन में नाइट्रोजन की द्रव्यमान प्रतिशतता है _____.

Sol. 37.83%

Histamine



Molecular formula is $\text{C}_5\text{H}_9\text{N}_3$

Molecular wt. = 111

$$\text{Mass \% of N} = \frac{42}{111} \times 100 = 37.83\%$$

- 24.** The hardness of a water sample containing 10^{-3} M MgSO_4 expressed as CaCO_3 equivalents (in ppm) is _____.
(molar mass of MgSO_4 is 120.37 g/mol)

- 24.** 10^{-3} M MgSO_4 वाले जल के प्रतिदर्श की कठोरता जिसको CaCO_3 समतुल्य (ppm में) अभिव्यक्त किये जाने पर, होगी _____.
(MgSO_4 का मोलर संहति 120.37 g/mol)

Sol. 100 ppm

$$\text{MgSO}_4 \ 10^{-3} \text{ mol/lit} = 10^{-3} \text{ mol/lit of CaCO}_3$$

$$\text{Hardness is ppm} = 10^{-3} \times 100\text{g} \times 1000 \frac{\text{mg}}{\text{g}}$$

$$= 100 \text{ mg/lit} = \frac{100 \times 10^{-3}}{1000}$$

$$= 100 \text{ ppm}$$

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25. The molarity of HNO_3 in a sample which has density 1.4g/mL and mass percentage of 63% is _____. (Molecular Weight of $\text{HNO}_3 = 63$)
25. उस प्रतिदर्श में, जिसका घनत्व 1.4 g/mL तथा द्रव्यमान प्रतिशतता 63% की हो, HNO_3 की मोलरता होगी _____. (HNO_3 का अणुभार = 63)

Sol. 14

$$M = \frac{\% W/W \times \text{density} \times 10}{\text{molecular weight of solute}}$$

$$M = \frac{63 \times 1.4 \times 10}{63} = 14$$

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