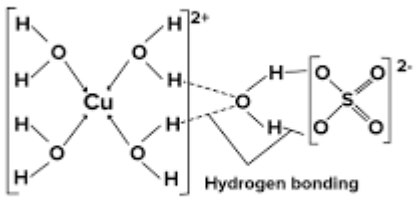
JEE-Main-01-02-2024 (Memory Based)
[EVENING SHIFT]

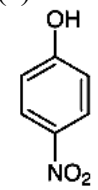
Chemistry

Question: Number of radial nodes present in 3p are
Options:
(a) 0
(b) 1
(c) 2
(d) 4
Answer: (b)
Solution: Number of radial nodes = n – l – 1
∴ Number of radial nodes for 3p orbital = 3 – 1 – 1 = 3 – 2 = 1

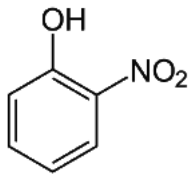
Question: Which of the following compound have colour due to d-d transition ?
Options:
(a) $KMnO_4$
(b) $K_2Cr_2O_7$
(c) K_2CrO_4
(d) $CuSO_4.5H_2O$
Answer: (d)
Solution:



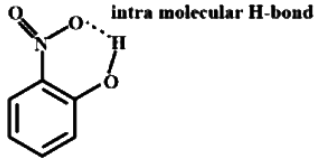
Question: Which of the following compounds has intramolecular hydrogen bonding in it ?
Options:
(a) NH_3
(b) H_2O
(c)

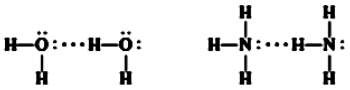


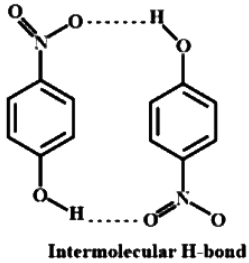
(d)



Answer: (d)
Solution:







Question: Which of the following has highest 3rd ionization energy?
Options:
(a) Mn
(b) V
(c) Cr
(d) Fe
Answer: (a)
Solution: Mn= [Ar] $3d^5$ $4s^2$
Third electrons remove from half filled shell so need more energy to remove this electron.

Question: A 10 mL hydrocarbon (C_x H_y) on combustion give 40 mL CO_2 and 50 mL H_2O. Calculate the value of x+y
Options:
(a) 14
(b) 12
(c) 11
(d) 17
Answer: (a)
Solution: The ratio of volumes is = 10 : 40 : 50 = 1 : 4 : 5
All the carbon from the hydrocarbon is in the CO_2. 10 ml of hydrocarbon produces 40ml of CO_2 1 : 4 ratio.

So, 1 mole of hydrocarbon has four moles of carbon.

10 ml of hydrocarbon produces 50 ml water 1 : 5 ratio,

x = 4; y = 10
x + y = 14

Question: Solubility of Ca_3 $(PO_4)_2$ in 100 mL of pure water is W gm. Find out K_{5p} of $Ca_3(PO_4)_2$ is :

(M : Molecular mass of $Ca_3(PO_4)_2$)

Options:

(a) $108\times\left(\frac{W}{M}\right)^5$

(b) $108\times10^4\times\left(\frac{W}{M}\right)^5$

(c) $108\times10^5\times\left(\frac{W}{M}\right)^5$

(d) $108\times10^6\times\left(\frac{W}{M}\right)^5$

Answer: (b)

Solution:

The expression for the solubility product of $Ca_3(PO_4)_2$ is

$K_{sp} = [Ca^{2+}]^3[PO_4^{3-}]^2$.

Substitute values in the above expression.

$K_{sp} = [3\times\frac{10\times W}{M}]^3[2\times\frac{10\times W}{M}]^2 = 108(\frac{10\times W}{M})^5$.

Question: Which of the following set of elements can be detected by Lassaigne's test?

Options:

(a) N and S only

(b) N, P and S only

(c) P and halogens only

(d) N, P, S and halogens

Answer: (d)

Solution: Nitrogen, sulphur, and halogens present in organic compounds are detected by Lassaigne's test. Here, a small piece of Na metal is heated in a fusion tube with the organic compound.

Question: Which of the following compounds in 3d series does not show +3 oxidation state ?

Options:

(a) V

(b) Cr

(c) Mn

(d) Cu

Answer: (d)

Solution:

Table 8.3: Oxidation States of the first row Transition Metals (the most common ones are in bold types)

Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
	+2	**+2**	**+2**	**+2**	**+2**	**+2**	**+2**	**+1**	**+2**
+3	**+3**	**+3**	**+3**	**+3**	**+3**	**+3**	**+3**	**+2**	
	+4	**+4**	**+4**	**+4**	**+4**	**+4**	**+4**		
		+5	**+5**	**+5**					
			+6	**+6**	**+6**				
				+7					

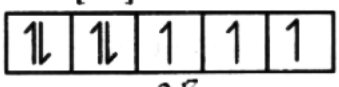
Question: What is the order of reducing character for AsH_3, NH_3, PH_3 (group 15 hydrides)?
Options:
(a) $NH_3 > PH_3 > AsH_3$
(b) $PH_3 > NH_3 > AsH_3$
(c) $AsH_3 > PH_3 > NH_3$
(d) $NH_3 > AsH_3 > PH_3$
Answer: (c)
Solution:
Reactivity towards hydrogen: All the elements of Group 15 form hydrides of the type EH_3 where E = N, P, As, Sb or Bi. Some of the properties of these hydrides are shown in Table 7.2. The hydrides show regular gradation in their properties. The stability of hydrides decreases from NH_3 to BiH_3 which can be observed from their bond dissociation enthalpy. Consequently, the reducing character of the hydrides increases. Ammonia is only a mild reducing agent while BiH_3 is the strongest reducing agent amongst all the hydrides. Basicity also decreases in the order $NH_3 > PH_3 > AsH_3 > SbH_3 \geq BiH_3$.

Question: Assertion: $[Fe(H_2O)_5\ NO]SO_4$ is paramagnetic
Reason: The Fe in $[Fe(H_2O)_5NO]SO_4$ has three unpaired electrons.
Options:
(a) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion
(b) Both Assertion and Reason are correct but Reason is not the correct explanation for Assertion
(c) Assertion is correct but Reason is incorrect
(d) Both Assertion and Reason are incorrect
Answer: (a)
Solution:

$Fe^+ : [Ar]\ 3d^6\ 4s^1$

When the weak field ligand H_2O and strong field ligand NO attack, the configuration changes as follows:

$Fe^+ : [Ar]\ 3d^7\ 4s^0$



$3d^7$

$\therefore$ Fe^+ has 3 unpaired electrons.

Question: Consider the following complex $[Co(NH_3)_5\ CO_3]ClO_4$
The coordination number, oxidation number, number of d-electrons and number of unpaired d-electrons on the meal are respectively
Options:
(a) 6, 3, 6, 0
(b) 7, 2, 7, 1
(c) 7, 1, 6, 4
(d) 6, 2, 7, 3
Answer: (a)
Solution: $[Co(NH_3)_5\ CO_3]\ ClO_4$. Six mondentate ligands are attached to Co hence C. N of Co = 6
O . N = $x + 5 \times (0) + 1 \times (-2) + 1 \times (-1) = 0$

$\therefore$ x = + 3; electornic configuration of Co^{3+} [Ad] $3d^6\ 4s^0$ hence number of d electrons is 6: All d electrons are paired due to strong ligand hence unpaired electrons Zero.