BYJU'S EXAM PREP

CSIR NET Exam 2022 Exam Analysis (Chemical Science 16th February)

Memory Based Questions

GENERAL APTITUDE (Part-A)

Memory Based Questions (Quantitative Aptitude)

Topic-Number System

Q1. If m + n + (m×n) = 118

Then what will be the value of M + N

Solution- Here we need to find the value of M + N then. This type of question can be solved using the option.

So, we have question, m + n + (M × N) = 118

By putting the value of M = 16; and

N = 6 from option. Then ,

16 + 6 + (16 × 6) = 118

Here the asked value of M + N.

∴ M + N = 2

16 + 6

Topic- Speed, Distance & Time

Q2. Train runs 36km/hr. It crosses a mark on a platform in 8 sec and crosses the platform in 20 seconds. What is the length of the platform?

Solution-

Speed of train = 36 km $= 36\text{km} \times \frac{5}{18} = 10\text{m/s}$

Now let be the length of platform be x

So, here length of train = 10 × 8 = 80m

∴ length of platform $= \frac{80+x}{10} = 20$

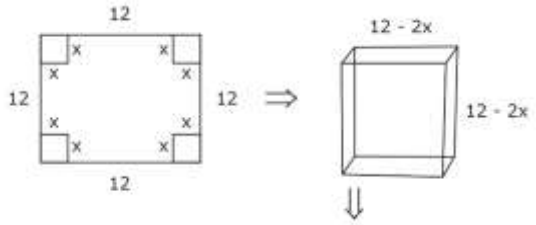
$\Rightarrow$ 80 + x = 200

$\Rightarrow$ x = 200 – 80 $\Rightarrow$ 120 m

Topic- Mensuration

Q3. 12×12 square sheet is being cut into 4 squares and made into a tray. What should be the minimum edge of the square in order to keep the volume tray maximum?

Solution-



Volume = l × b × h = $(12 - 2x)^2 \times x$

$v = 4x(x^2 + 36 - 12x)$

$v = dx^3 - 48x^2 + 144x$

$$\frac{dv}{dx} = 12x^2 - 96x + 144 = 0$$

$x^2 - 8x + 12 = 0$

$$x = \frac{8 \pm \sqrt{64 - 48}}{2} = 4 \pm \frac{4}{2} = 6$$

Now $\frac{d^2v}{dx^2} = 24x - 96$

at x = 2; $\frac{d^2v}{dx^2} < 0$ is at x = 2 the vol. is maximum

and at x = b; $\frac{d^2v}{dx^2} > 0$ is, the volume will be minimum

Topic-Problems On Age

Q4. Father's age is 5 years more than the mother's age. The mother's present age is three times her daughter's age. The present age of the daughter is 12 years. What was the age of the father when the daughter was born?

Solution- Let father age be 3x + 5 →41

Mother =3x→36

Daughter= x → 12

Therefore Father's age when daughter was born 41-12= 29

Memory Based Questions (Reasoning)

Topic- Logical Puzzles

Q5. A tells only lies on Monday, Tuesday and Wednesday and speaks only the truth for the rest of the week. B tells only lies on Thursday, Friday and Saturday and speaks only the truth for the rest of the week. If today both of them state that they have lied yesterday, what day is it today?

A. Monday **B. Thursday**

C. Sunday **D. Tuesday**

Solution- Here A lies on Monday, Tue wed and B lies on Thu, Fri, Sat

If today A and B both say they have lied yesterday

Now if we considered Thursday the present day (today),

→ On Thursday A said he lie yesterday means he is true because, yesterday was Wednesday, (the day A lies normally)

→ On Thursday B said he lied yesterday means he is surely lying because yesterday was Wednesday and on Wednesday he doesn't lie.

It means B lied today i.e Thursday.

So, by considering both statements today will be Thursday.

Q6. $81^{1/3} \times 81^{1/9} \times 81^{1/27} \times 81^{1/81}$ …… till infinity the value would be

A. 3

B. 9

C. 27

D. 81

Solutions-

$81^{1/3} \times 81^{1/9} \times 81^{1/27} \times 81^{1/81}$ ……. Till infinity

The value would be-

$$(8)^{\frac{1}{3}+\frac{1}{9}+\frac{1}{27}+\frac{1}{81}\ldots\ldots\infty}$$

$$=(81)^{\frac{1}{2}}=9$$ Ans

CHEMICAL SCIENCE

Memory Based Questions

Q1. For the given reaction,

$\log k = 14.1 - \frac{10000}{T}$ **. Find the value of activation energy E_a?**

Solution:

Since we know that, $k = A\, e^{-E_a/RT}$ (From Arrhenius equation)

On taking its log;

$$\therefore \quad \log k = \log A - \frac{E_a}{2.303RT} \longrightarrow \text{eq (1)}$$

and given, $\log k = 14.1 - \frac{10000}{T} \longrightarrow \text{eq (2)}$

on comparing both equations –

$$\frac{10^4}{T} = \frac{E_a}{2.303R\ T}$$

$$\boxed{E_a = 10^4 \times R \times 2.303} = 10^4 \times 8.314 \times 2.303$$

$$= 191471.42 \text{ J/mol}$$

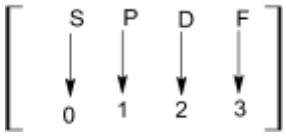
2. Give the total number of microstates corresponding to the 4F term.

Solution: Since term given is ^4F

and we know that - $^{2S+1}L_J$

So, (2S + 1) = 4 = spin multiplicity

and term is F; so value of L is = 3



No. of microstates = $[2S+1]\,[2L+1]$

$$= 4 \times [2 \times 3 + 1]$$

$$= 4 \times 7$$

$\therefore$ No. of microstates = 28

3. Match the column-

(P) Hemerythrin	**(1) O_2 transport**
(Q) Hemocyanin	**(2) electron transport**
(R) Resky Protein	**(3) Oxidation**
(S) Cytochrome P450	
(T) Tyrosinase	
(U) Azurin	

Solution: Hemerythrin and Hemocyanin both help in Oxygen transport. So, P and Q matches with (1)

- Azurin and Resky Protein both leads to electron transport. So (R) and (U) matches with (2).
- Cytochrome P – 450 and Tyrosinase helps in oxidation. So, (S) and (T) matches with (3).

4. S_3^6 and S_6^3 are equivalent to which operation?

Solution: For $S_6^3 = C_6^3 \times \sigma^3$

$= C_2^1 \times \sigma$ (Since σ applied add times is equal to σ)

$= C_2 \times \sigma$

$= S_2 = i$

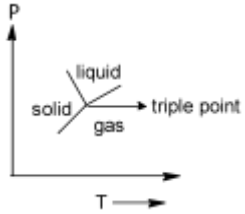
For S_3^6

Here, value of n = 3 = odd and $S_n^{2n} = E$ (when n = odd)

So, $S_3^6 = E$

5. What are the maximum number of phases present in a 1 component system that can coexist together?

Solution: Since we know, for 1 component system phase diagram is as follows –



So, at the triple point, 3 phases coexist.

Hence, the answer is 3

6. Which among the following molecules is IR active but not microwave active?

A. HCl

B. N_2

C. C_2H_2

D. H_2O

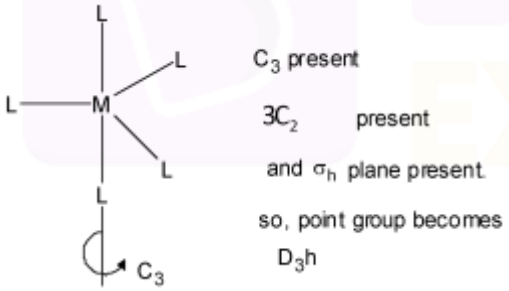
Solution: Any molecule given will be IR active if it possesses some dipole moment.

So, HCl has a dipole moment. Hence it is both IR active and microwave active.

For, $C_2H_2 \rightarrow$ its asymmetric stretch is IR (vibrational) active and microwave inactive. Since no permanent dipole moment present.

7. For ML_5 arrangement predict point group and the symmetry of orbitals.

Solution:



and for symmetry of orbitals: we know that for ML_5 arrangement is as follows-

——— $dx^2 - y^2$

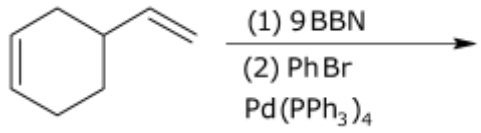
——— dz^2

——— dxy

——— ———

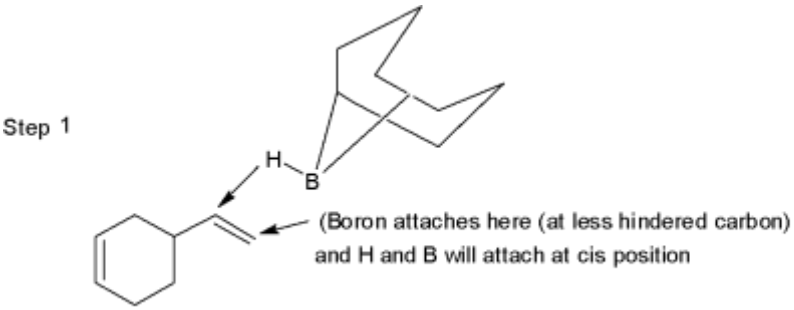
dxz dyz

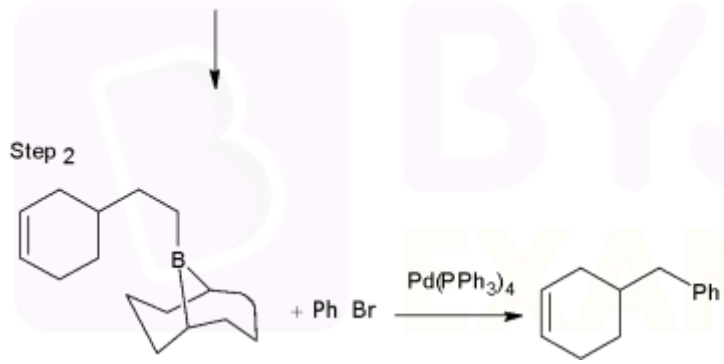
8. For the following reaction, give the product?

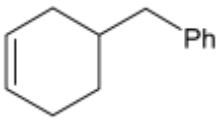


Solution: This is the Suzuki reaction.

Here, Boron will go to less hindered carbon of double bond.





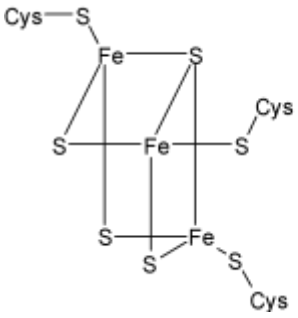
So, the answer is 

9. In 3Fe Ferredoxin, find the number of sulphide bridge and S-cystine ligand.

Solution: 3 Fe ferredoxin is Fe_3S_4

Its general form is Fe_xS_y

Here, y explains the Number of labile Sulphur.



So, S-Cystine = 3

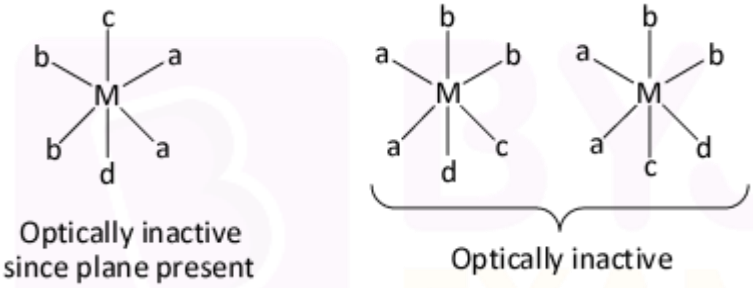
and no. of sulphide bridge = 4

10. Find the number of enantiomeric pairs for Ma_2b_2cd.

Solution:

Step 1: Draw all possible structures for this Ma_2b_2cd.

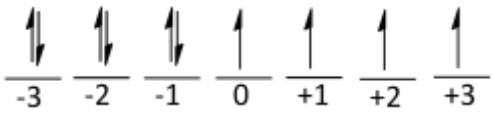
Step 2: Check if POS and COS are both absent; then such structure will be optically active. Thus, it will have enantiomeric pair.



So, number of enantiomeric pairs = 2

11. Find an effective magnetic moment for f^{10} configuration.

Solution:



$$\mu = g\sqrt{J(J+1)}$$

And $$g = \frac{3}{2} + \frac{S(S+1) - L(L+1)}{2J(J+1)}$$

Here, L = 0 + 1 + 2 + 3 = 6

$$S = \left(\frac{1}{2}\right) \times 4 = 2$$

$$J = J_{max} = (J+S) = 6+2 = 8$$

So, $$g = \frac{3}{2} + \frac{S(S-1) - L(L+1)}{2J(J+1)}$$

$$g = \frac{3}{2} + \frac{2(2+1) - 6(6+1)}{2 \times 8(8+1)}$$

$$g = \frac{3}{2} + \frac{6-42}{16 \times 9}$$

$$g = \frac{3}{2} - \frac{36}{144}$$

$$g = \frac{432-72}{288}$$

$$g = \frac{360}{288}$$

g = 1.25

Now, $$\mu = g\sqrt{J(J+1)}$$

$$\mu = 1.25\sqrt{8(8+1)}$$

$$= 1.25\sqrt{72}$$

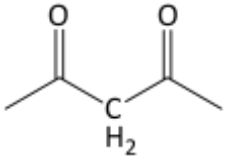
=1.25 × 8.48

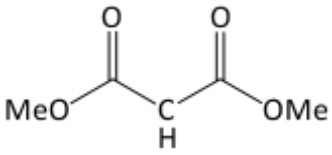
$$\mu = 10.6BM$$

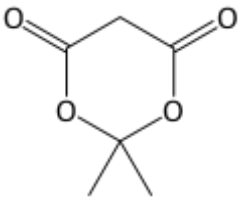
12. Find commutator value for [x, p_x^2].

Solution: We know that [x, p_x^n] = + p_x . n i $\hbar = 2i\hbar p_x$

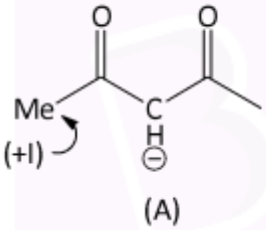
13. Find the pk_a trend for the following-

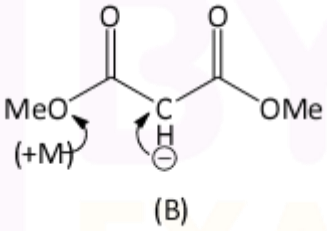
A. 

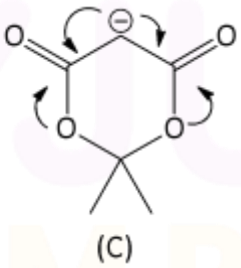
B. 

C. 

Solution: For pk_a trend, we see basicity. Hence, form its anion and then check stability-







Order of acidity: A > B > C

Order of log k_a: A > B > C

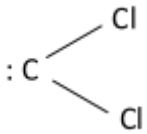
$pk_a = -\log k_a$

Therefore, order of pk_a is C > B > A

14. What is formed as a product from following reaction

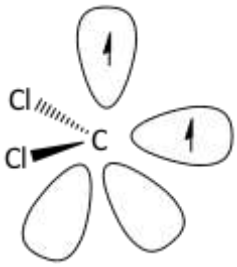
$CHCl_3 + KOH \rightarrow (P)$

Solution:

$CHCl_3 + KOH \rightarrow$ 

triplet carbene

⇓



15. For the given complexes, give geometry and electron count-

A. $Os_4(CO)_{16}$

B. $[Os_6(CO)_{18}P]^-$

C. $[Ru_6(CO)_{17}B]^-$

Solution: TVE for $Os_4(CO)_{16}$ is:

TVE = (8 × 4) + (2 × 16) = 32 + 32 = 64; So, Square planar

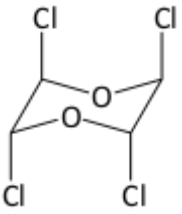
TVE for $[Os_6(CO)_{18}P]^-$ is:

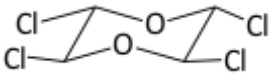
TVE = (8 × 6) + (2 × 18) + 5 + 1 = 48+ 36 + 6 = 90; So, Trigonal Prism

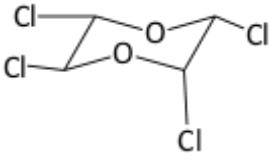
TVE for $[Ru_6(CO)_{17}B]^-$ is:

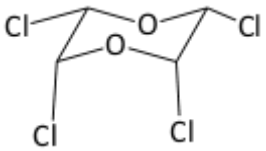
TVE = (8 × 6) + (2 × 17) + 3 + 1 = 48 + 34 + 4 = 86; So, Monocapped Square Pyramid

16. Most stable form among the given structure is?

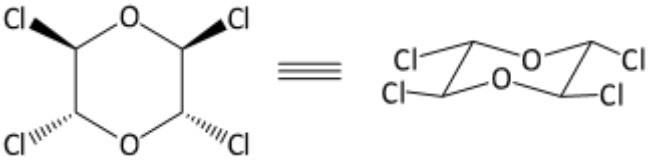
A.


B.


C.


D. 

Solution:1,3-diaxial is a less stable position. Axial bonds are less stable than equatorial bonds. Hence, a structure like this having all positions equatorial is the most stable.



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