CHEMISTRY

BOOKS - JEE ADVANCED PREVIOUS YEAR

JEE ADVANCED 2020

Section 1

1. The 1^{st}, 2^{nd} and the 3^{rd} ionization enthalpies. I_1, I_2, I_3 of four atoms with atomic numbers $n, n+1, n+2$ and $n+3$, where $n < 10$, are

tabulated below. What is the value of n?

Atomic number	Ionization Enthalpy (kJ/mol)		
	I_1	I_2	I_3
n	1681	3374	6050
$n+1$	2081	3952	6122
$n+2$	496	4562	6910
$n+3$	738	1451	7733

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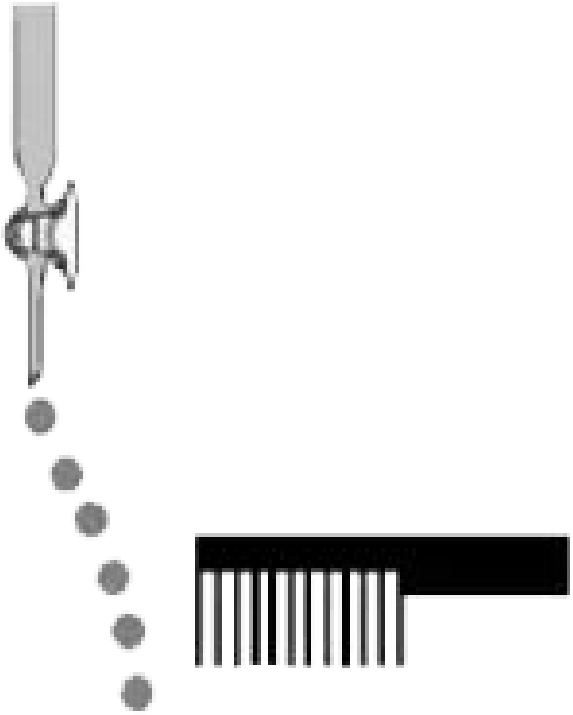
2. Consider the following compounds in the liquid form :

$O_2, HF, H_2O, H_2O_2, CCi_3, CHCl_3, C_6H_6, C_6H_5Cl.$

When a charged comb is brough near their flowing steam, how many of

them show deflection as per the following figure?



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3. In the chemical reaction between stoichiometic quantities of $KMnO_4$ and Kl in weakly basic solution, what is the number of moles of I_2 released for 4 moles of $KMnO_4$ consumed?

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4. An acidified solution of potassium chromate was layered with an equal volume of amyl alcohol. When it was shaken after the addition of 1ml of 3% H_2O_2, a blue alcohol layer was obtianed. The blue color is due to the formation of a chromium (VI) compound 'X'. What is the number of oxygen atoms bonded to chromium through only single bonds in a molecule of 'X' ?

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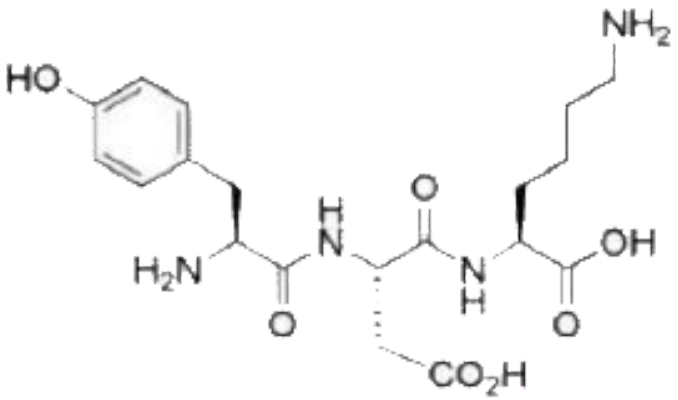
5. The structure of tripeptide will be as followed at PH = 2 (in highly acidic medium)



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6. An organic compound $(C_8H_{10}O_2)$ rotates plane-polarized light. It produces pink colour with neutral $FeCl_3$ solution. What is the total number of all the possible isomers for this compound?

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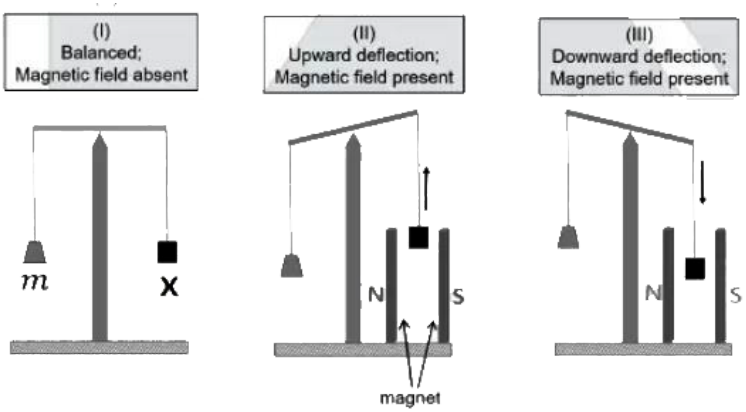
Section 2

1. In an experiment, grams of a compound X (gas/liquid/solid)taken in a container is loaded in a balance as shown in figure I below. In the prasence of a magnetic field, the pan with X is either deflected upwards (figure II), or deflected downwards (figure III), dependign on the

compound X. Identify the correct statement(s).



A. If X is $H_2O(l)$, deflection of the pan is upwards.

B. If X is $K_4[Fe(CN)6](s)$, deflection of the the pan is upwards

C. If X is $O_2(g)$, deflection of the pan is downwards.

D. If X is $C_6H_6(l)$, deflection of the pan is downwards

Answer: A::B::C

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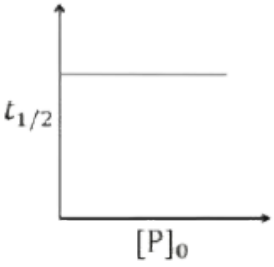
2. Which of the following plots is(are) correct for the given reaction? ($[P]_0$ is the initial consentration of P)

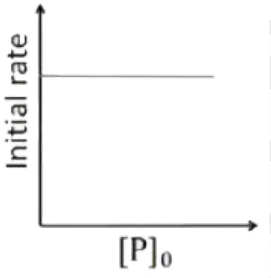

CH3
H3C
Br
CH3
+
NaOH
CH3
H3C
OH
CH3
+
NaBr

P Q

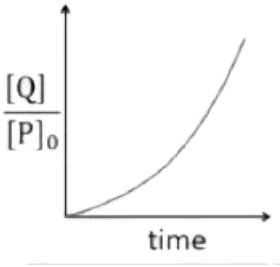
A.


$t_{1/2}$
$[P]_0$

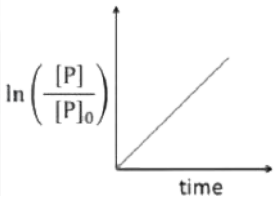
B.


Initial rate
$[P]_0$

C.


$\frac{[Q]}{[P]_0}$
time

D.


$\ln\left(\frac{[P]}{[P]_0}\right)$
time

Answer: A

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3. Which among the following statement(s) is (are) true for the extraction of aluminium from bauxite ?

A. Hydrated Al_2O_3 precipitates, when CO_2 is bubbled through a solution of sodium aluminate

B. Addition of Na_3AlF_6 lower the melting point of alumina.

C. CO_2 is evolved at the anode during electrolysis.

D. The cathode is a steel vessel with a lining of carbon.

Answer: A::B::C::D

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4. Choose the correct statement(s) among the following.

A. $SnCl_2.2H_2O$ is reducing agent.

B. SnO_2 reacts with KOH to form $K_2\left[Sn(OH)_6\right]$.

C. A solution of $PbCl_2$ in HCl contains Pb^{2+} and Cl^- ions.

D. The reaction of Pb_3O_4 with hot dilute nitric acid to give PbO_2 is a redox reaction.

Answer: A::B

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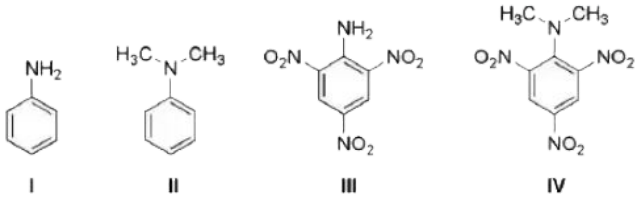
5. Consider the following four compounds I, II, III, and IV.



I II III IV

Choose the correct statement(s).

A. The order of basicity is $II > I > III > IV$.

B. The magnitude of pK_b difference between I and II is more than that between III and IV.

C. Resonance effect is ore in III in IV.

D. Steric effect makes compound IV more basic than III

Answer: C::D

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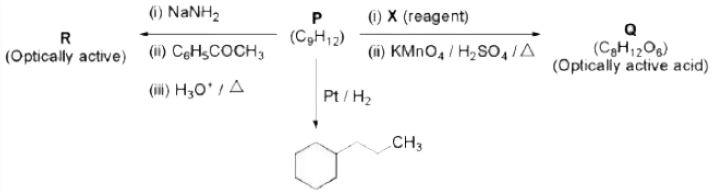
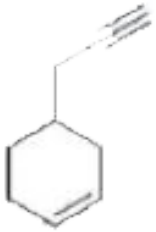
6. Consider the following transformations of a compound P.



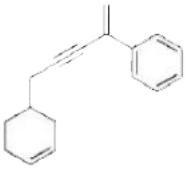
Choose the correct option(s)



A. P is

B. X is Pd - C/quinoline/H_2

C. 

D. 

Answer: B::C

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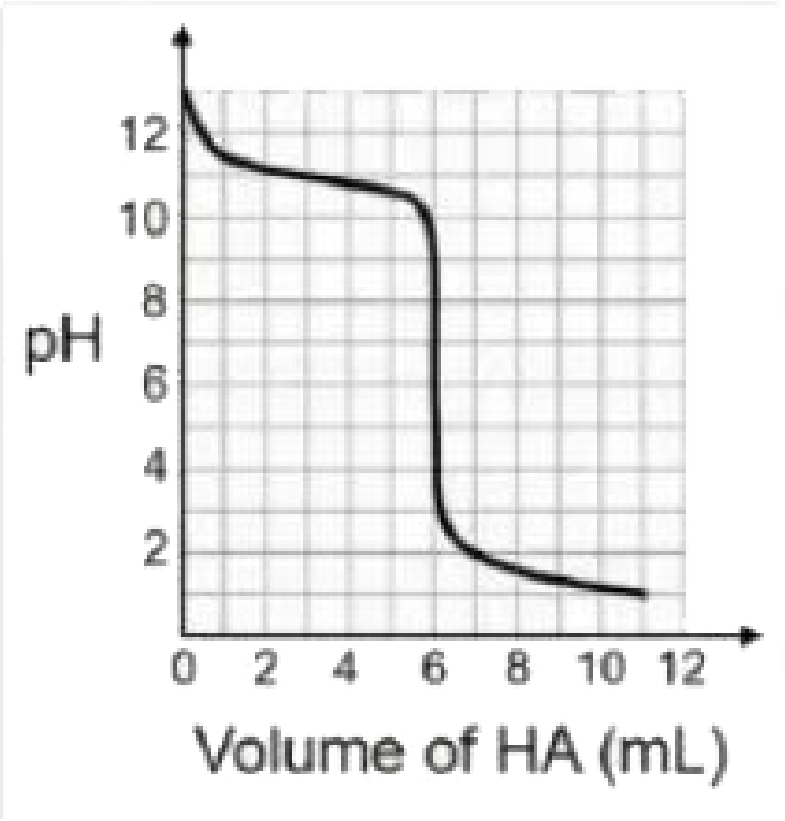
Section 3

1. A solution of 0 .1 weak base (B)is titrated with 0.1 M of a strong acid (HA) . The variation of pH of the solution will be the volume of HA added is shown in the figure below. What is the pK_b of the base ? The

neutralization reaction is given by $B + HA \rightarrow HA \rightarrow BH^{+} + A^{-}$



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2. Liquids A and B from ideal solution for all composition of A and B at $25^{\circ} C$ Two such solutions with 0.25 and 0.50 mole fractions of A have the total vapor pressures of 0.3 and 0.4 , respectively . What is the vapor pressure of pure B in bar ?

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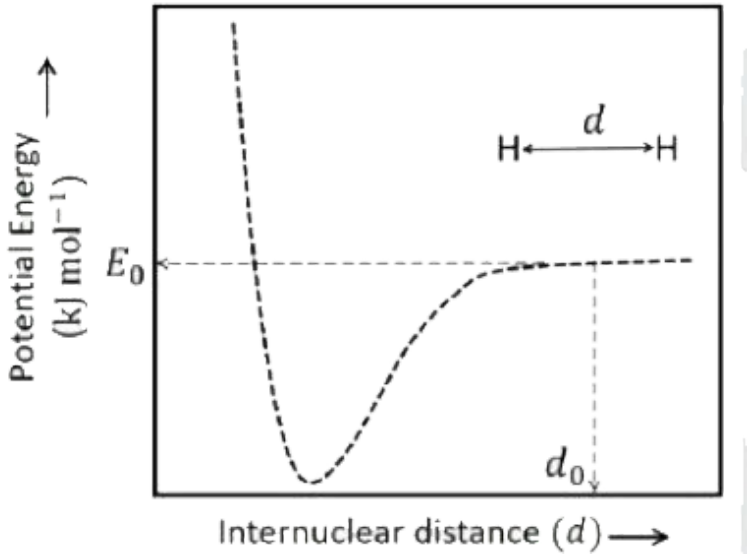
3. The figure is the plot potential energy versus internuclear distance (d) of H_2 molecule in the electronic ground state. What is the value of the net potential energy E_0 (as indicated in the figure) in kJ mol^{-1} , for $d = d_0$ at which the electron repulsion and the nucleus - nucleus repulsion energies are absent ? As reference , the potential energy of H atom is taken as zero when its electron and the nucleus are infinitely far apart.

use Avogadro as $6.023 \times 10^{23} \text{mol}^{-1}$.



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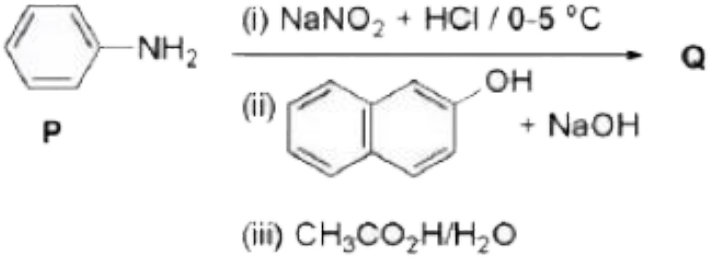
4. Consider the reaction sequence from P to Q shown below . The overall yield of the major product Q from P is 75% . What is the amount in grams Q obtained from 9.3 mL of P ? (Use density of P = 1.00 $\mathrm{g\,mL^{-1}}$, Molar of C = 12.0 , H = 1.0 , O = 16.0 and N = $14.0\ \ \mathrm{g\,m}^{-1}$



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5. Tin is obtained from cassiterite by reduction with coke. Use the data given below to determine the minimum temperature (in K) at which the reduction of cassiterite by coke would take place .

at 298 K :

$\Delta_f H^0(SnSO_2(s)) = -5.81\mathrm{KJ\ mol^{-1}}, \Delta_f H^0(CO_2(g)) = -394.0\mathrm{kJ\ mol}$

,

$S^0(SnO_2(s)) = 56.0JK^{-1}\ \text{mol}^{-1}, S^0(Sn(s)) = 52.0JK^{-1}mol^{-1}$

$S^0(C(s)) = 6.0JK^{-1}mol^{-1}, S^0(CO_2(g)) = 210.0JK^{-1}mol^{-1}$

Assume that the enthalpies and the entropies are temperature independent.

A. 830

B. 865

C. 900

D. 935

Answer: D

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6. An acidified of $0.05MZn^{2+}$ is saturated with 0.1 M H_2S. What is the minimum molar concentration (M) or H^+ required to prevent the precipitation of ZnS ? Use $K_{sp}(ZnS) = 1.25 \times 10^{-22}$ and overall dissociation constant of H_2S, $K_{\text{NET}} = K_1K_2 = 1 \times 10^{-21}$.

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