



## CHEMISTRY

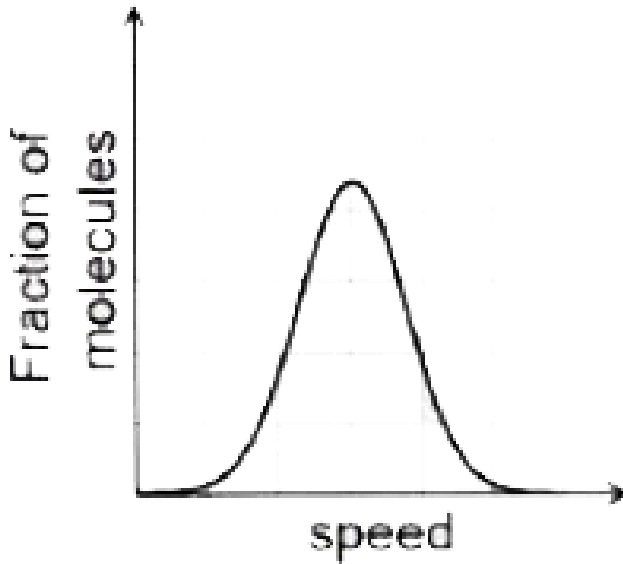
### BOOKS - JEE ADVANCED PREVIOUS YEAR

#### JEE (ADVANCED ) 2020

#### Section I

1. In the distribution of molecular speeds of a gas is as per the figure shown below, then the ratio of the most probable, the average, and the root mean

square speeds, respectively, is



A. 1 : 1 : 1

B. 1 : 1 : 1.224

C. 1 : 1.128 : 1.224

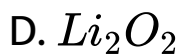
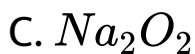
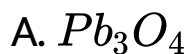
D. 1 : 1.128 : 1

**Answer: B**



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2. Which of the following liberates  $O_2$  upon hydrolysis?



**Answer: B**



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3. A colourless aqueous solution contains nitrates of two metals, X and Y. When it was added to an aqueous solution  $NaCl$ , a white precipitate was formed. This precipitate was found to be partly soluble in hot water to give a residue P and a solution Q. The residue P was soluble in aq.  $NH_3$  and also in excess sodium thiosulfate. The hot solution Q gave a yellow precipitate with  $KI$ . The metals X and Y, respectively, are :

A.  $Ag$  and  $Pb$

B.  $Ag$  and  $Cd$

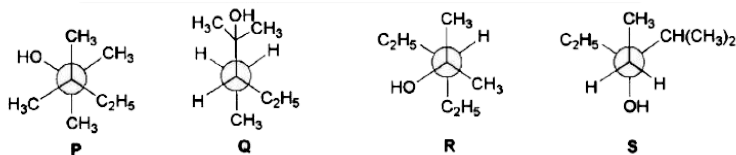
C. *Cd* and *Pb*

D. *Cd* and *Zn*

**Answer: A**

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4. Newman projections P, Q, R and S are shown below :



Which one of the following option represents identical molecules ?

A. P and Q

B. Q and S

C. Q and R

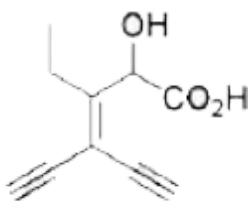
D. R and S

**Answer: C**

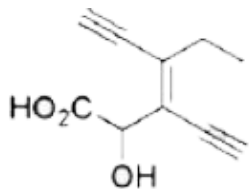


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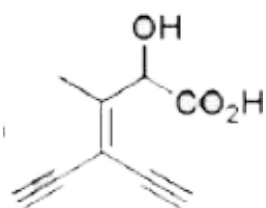
5. Which one of the following structures has the IUPAC name 3 - ethynyl -2- hydroxy -4- methylhex -3- en -5- ynoic acid?



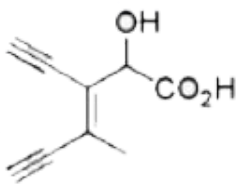
A.



B.



C.



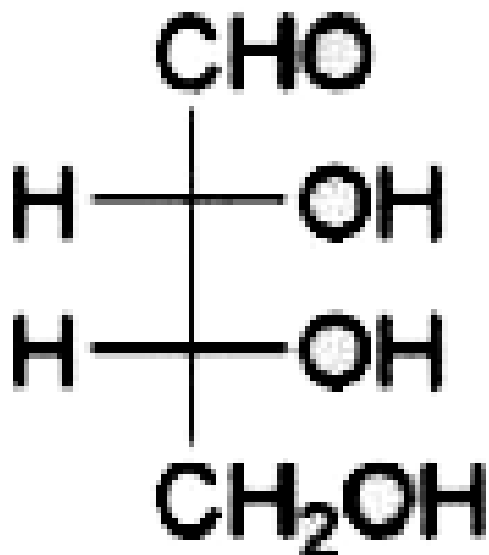
D.

**Answer: D**



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6. The Fischer projection of D - erythrose is shown below.

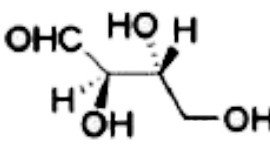
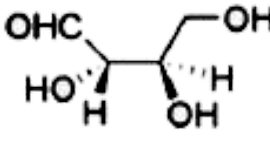
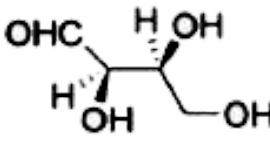
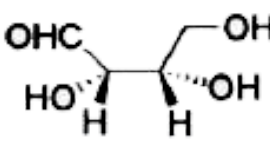


**D-Erythrose**

D - Erythrose and its isomers are listed as P, Q, R, and S in Column - I. Choose the correct relationship of P, Q, R, and S with D - erythrose



from Column II.

Column-I	Column-II
P. 	1. Diastereomer
Q. 	2. Identical
R. 	3. Enantiomer
S. 	

A.  $P \rightarrow 2, Q \rightarrow 3, R \rightarrow 2, S \rightarrow 2$

B.  $P \rightarrow 3, Q \rightarrow 1, R \rightarrow 1, S \rightarrow 2$

C.  $P \rightarrow 2, Q \rightarrow 1, R \rightarrow 1, S \rightarrow 3$

D.  $P \rightarrow 2, Q \rightarrow 3, R \rightarrow 3, S \rightarrow 1$

**Answer: C**



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## Section II

1. In thermodynamics, the  $P - V$  work done is given by

$$w = - \int dV P_{\text{ext.}}$$

For a system undergoing a particular process, the work done is ,

$$w = - \int dV \left( \frac{RT}{V-b} - \frac{a}{V^2} \right)$$

The equation is applicable to a

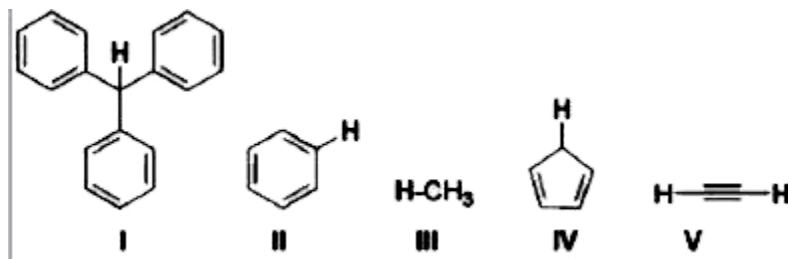
- A. system that satisfies the van der Waals equation of state.
- B. process that is reversible and isothermal
- C. process that is reversible and adiabatic.
- D. process that is irreversible and at constant pressure.

**Answer: A::B::C**



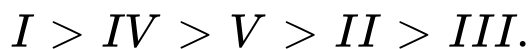
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2. With respect to the compounds *I* – *V*, choose the correct statement(s).



- A. The acidity of compound I is due to delocalization in the conjugate base.
- B. The conjugate base of compound IV is aromatic
- C. Compound II becomes more acidic, when it has a  $-NO_2$  substituent.

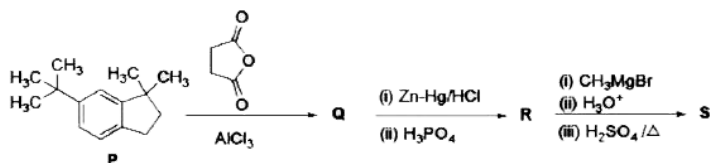
D. The acidity of compounds follows the order



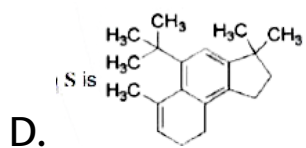
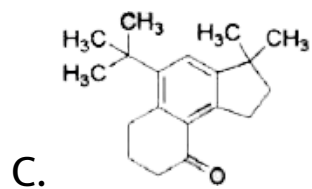
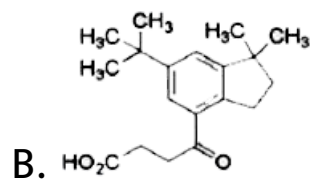
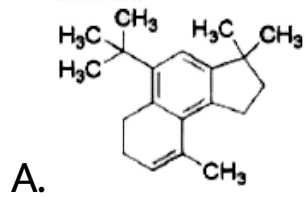
Answer: A::B::C

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3. In the reaction scheme shown below Q, R, and S are the major products.



The correct structure of



Answer: B::D



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

- A.  $[FeCl_4]^-$  has tetrahedral geometry.
- B.  $[Co(en)(NH_3)_2Cl_2]^+$  has 2 geometrical isomers.
- C.  $[FeCl_4]^-$  has higher spin - only magnetic moment than  $[Co(en)(CH_3)_2Cl_2]^+$ .
- D. The cobalt ion in  $[Co(en)(NH_3)_2Cl_2]^+$  has  $sp^3d^2$  hybridization.

**Answer: A:C**



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5. With respect to hypochlorite, chlorate and perchlorate ions, choose the correct statement(s).

A. The hypochlorite ion is the strongest conjugate base.

B. The molecular shape of only chlorate ion is influenced by the lone pair of electrons of Cl.



C. The hypochlorite and chlorate ions disproportionate to give rise to identical set of ions.

D. The hypochlorite ion oxidises the sulfite ion.

**Answer: A::B::D**



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**Section Iii**

1. 5.00 mL of 0.10 M oxalic acid solution taken in a conical flask is titrated against  $NaOH$  from a burette using phenolphthalein indicator. The volume of  $NaOH$  required for the appearance of permanent faint pink color is tabulated below for five experiments. What is the concentration, in molarity, of the  $NaOH$  solution?

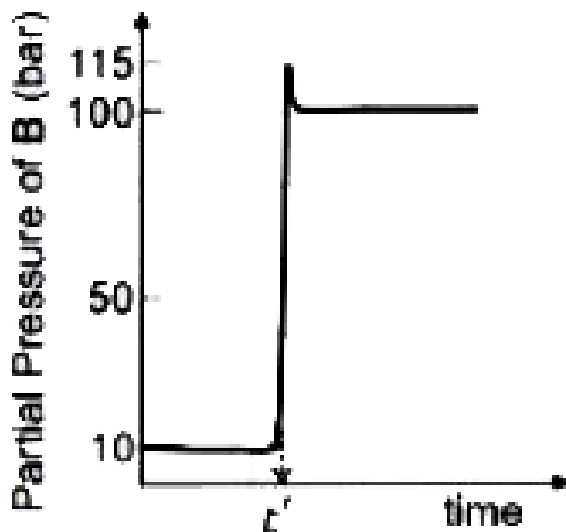
Exp. No.	Vol. of NaOH (mL)
1	12.5
2	10.5
3	9.0
4	9.0
5	9.0



2. Consider the reaction  $A \rightleftharpoons B$  at 1000 K. At time 't' the temperature of the system was increased to 2000 K and the system was allowed to reach equilibrium. Throughout this experiment the partial pressure of A was maintained at 1 bar. Given below is the plot of the partial pressure of B with time.

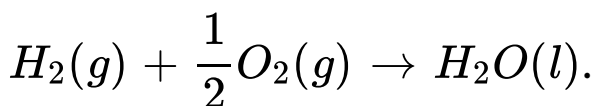
What is the ratio of the standard Gibbs energy of

the reaction at 1000 K to that at 2000 K ?



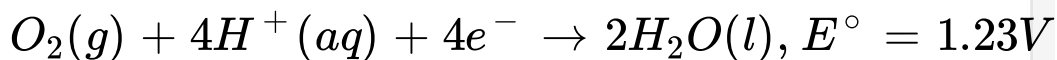
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3. Consider a 70% efficient hydrogen - oxygen fuel cell working under standard conditions at 1 bar and 298 K. Its cell reaction is

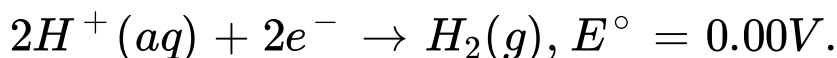


The work derived from the cell on the consumption of  $1.0 \times 10^{-3}$  mol of  $H_2(g)$  is used to compress 1.00 mol of a monoatomic ideal gas in a thermally insulated container. What is the change in the temperature (in K) of the ideal gas?

The standard reduction potentials for the two half-cells are given below.



,



Use  $F = 96500 \text{ C mol}^{-1}$ ,  $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$ .



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4. Aluminium reacts with sulfuric acid to form aluminium sulfate and hydrogen. What is the volume of hydrogen gas in litres (L) produced at 300 K and 1.0 atm pressure, when 5.4 g of aluminium and 50.0 mL 5.0 M sulfuric acid are combined for the reaction?

(Use molar mass of aluminium as  $27.0 \text{ g mol}^{-1}$ ,  $R = 0.082 \text{ atm L mol}^{-1} \text{ K}^{-1}$ )



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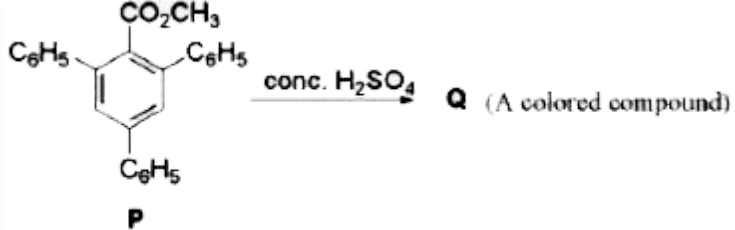
5.  ${}_{92}^{238}\text{U}$  is known to undergo radioactive decay to form  ${}_{82}^{206}\text{Pb}$  emitting alpha and beta particles. A

rock initially contained  $68 \times 10^{-6} \text{ g}$  of  ${}_{92}^{238}\text{U}$ . If the number of alpha particles that it would emit during its radioactive decay of  ${}_{92}^{238}\text{U}$  to  ${}_{82}^{206}\text{Pb}$  in three half - lives is  $Z \times 10^{18}$ , then what is value of Z?



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6. In the following reaction, compound Q is obtained from compound P via an ionic intermediate.



What is the degree of unsaturation of Q?



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