Shri Shantadurga Higher Secondary School, Bicholim-Goa.

Final Examination March-2020

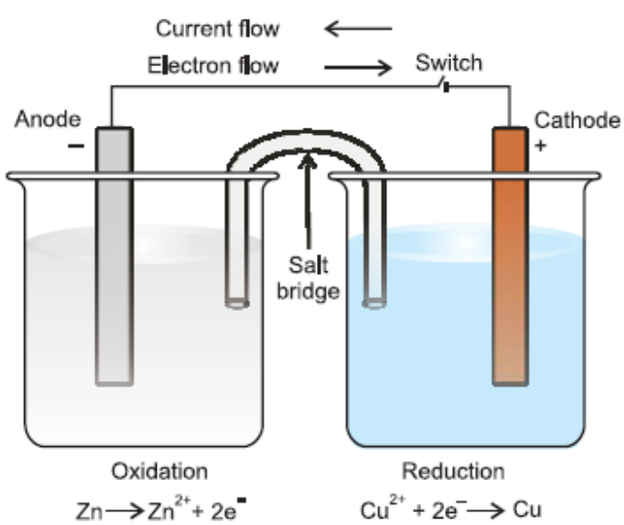
Std: XI Science **Max Marks: 55**

Date: 07/03/2020 **Chemistry Answer key** **Duration: 150 Minutes**

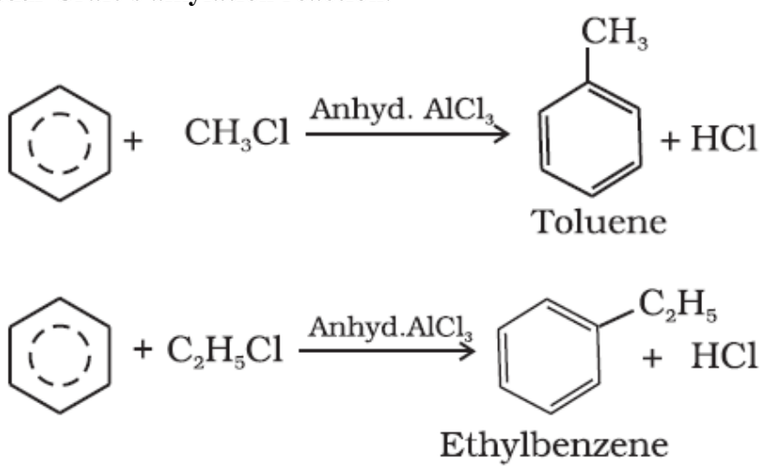
Instructions:-

*1. All questions are compulsory; however question **23, 26**, and **27** has internal choice.*
*2. Use of **calculator** is **not permitted**, however logarithmic table will be provided on request.*
3. Every Question should be attempted only once.

Section-A consists of 9 questions of 1 mark each.
Section-B consists of 10 questions of 2 marks each.
Section-C consists of 6 questions of 3 marks each.
Section-D consists of 2 questions of 4 marks each.

	Section-A	
Q.1.	The mathematical expression for the first law of thermodynamics when heat is supplied to the system and work is done by the system is **$\Delta U = q-w$** # $\Delta U = q + w$ # $\Delta U = -q + w$ # $\Delta U = q-w$ # $\Delta U = -q-w$	(1)
Q.2	The oxidation state of Mn is +7 in **$KMnO_4$** . # MnO_2 # **$KMnO_4$** # Mn_3O_4 # K_2MnO_4	(1)
Q.3.	The conjugate base of HSO_3^- is **SO_3^{2-}** . a)H_2SO_4 b)**SO_3^{2-}** c)HSO_4^- d)H_2SO_3	(1)
Q.4.	The most Thermally unstable metal carbonate which decomposes to give metal oxide and CO_2 among the following is **$MgCO_3$.** a)$MgCO_3$ b)$CaCO_3$ c)$SrCO_3$ d)$BaCO_3$.	(1)
Q.5.	Boric acid is an acid because its molecule **accepts OH^- from water releasing proton.** # contains replaceable H^+ ion # combines with proton from water molecule # **accepts OH^- from water releasing proton** # gives up a proton	(1)
Q.6.	Write a mathematical expression showing relation between standard Gibbs free energy change and equilibrium constant K. **Ans: $\Delta G^0 = -2.303RT \log K$**	(1)
Q.7	Draw a neat labelled diagram of **Daniel Cell**. 	(1)
Q.8	Write a point of distinction between oxidation and reduction with respect to the oxidation number. **Oxidation: oxidation number increases** **Reduction: oxidation number decreases**	(1)
Q.9	Write the **IUPAC name** and **symbol** for the element having atomic number **107**. **Unnilseptium** **Uns**	(1)

	Section-B	(2)
Q.10	An aqueous solution of copper sulphate appeared blue in colour. When zinc powder was added to the same blue solution, copper sulphate solution slowly turned colourless. (a) Name the type of redox reaction taking place in the above process. **Metal displacement redox reaction** (b) Identify and write the substance undergoing oxidation and reduction in the same. **Oxidation: Zinc and reduction: copper**	(2)
Q.11	Answer the following using the given standard electrode potential values. $E^\circ_{Cr^{3+}/Cr} = -0.75V$ and $E^\circ_{Fe^{2+}/Fe} = -0.45V$ (a) Calculate e.m.f. of the cell. **Emf= E^0 cathode – E^0 anode** **= -0.45 – (-0.75) = 0.30V** (b) Name the oxidising agent. **Iron**	(2)
Q.12	With respect to group 2 elements explain the following: a) Trends in ionization enthalpy down the group Since the **atomic size increases down the group**, their **ionization enthalpy decreases** *The first ionisation enthalpies of the alkaline earth metals are higher than those of the corresponding Group 1 metals.* *This is due to their small size as compared to the corresponding alkali metals.* *It is interesting to note that the second ionisation enthalpies of the alkaline earth metals are smaller than those of the corresponding alkali metals.* b) **Any two** diagonal relationships between lithium and magnesium. (i) Both lithium and magnesium are harder and lighter than other elements in the respective groups. (ii) Lithium and magnesium react slowly with water. Their oxides and hydroxides are much less soluble and their hydroxides decompose on heating. (iii) Both form a nitride, Li_3N and Mg_3N_2, by direct combination with nitrogen. (iv) The oxides, Li_2O and MgO do not combine with excess oxygen to give any superoxide. (v) The carbonates of lithium and magnesium decompose easily on heating to form the oxides and CO_2. Solid hydrogencarbonates are not formed by lithium and magnesium. (vi) Both LiCl and $MgCl_2$ are soluble in ethanol. (vii)Both LiCl and $MgCl_2$ are deliquescent and crystallise from aqueous solution as hydrates, $LiCl\cdot 2H_2O$ and $MgCl_2\cdot 8H_2O$.	(2)
Q.13	a) Write the preparation of $NaHCO_3$ with a balanced Chemical reaction. $$\mathbf{Na_2CO_3 + H_2O + CO_2 \rightarrow 2NaHCO_3}$$ b) State any two uses of **Caustic Soda**. Manufacturing of paper ,artificial silk, soaps and chemicals ,in petroleum refining purification of bauxite ,in textile industries , preparation of pure fats and oils and as a laboratory reagent	(2)
Q.14	Give reason for the following. a) Carbon shows anomalous behaviour. **Small size, high ionization enthalpy, high electronegativity, absence of d orbital** b) Diamond is the hardest substance on the earth. **Due to extended covalent bond which is difficult to break**.	(2)
Q.15	Write the chemical reaction for each of the following: **a) Wurtz reaction** Alkyl halides on treatment with sodium metal in dry ethereal (free from moisture) solution give higher alkanes. This reaction is known as **Wurtz reaction** and is used for the preparation of higher alkanes containing even number of carbon atoms.	(2)

	$CH_3Br + 2Na + BrCH_3 \xrightarrow{\text{dry ether}} CH_3-CH_3 + 2NaBr$ Bromomethane Ethane $C_2H_5Br + 2Na + BrC_2H_5 \xrightarrow{\text{dry ether}} C_2H_5-C_2H_5 + 2NaBr$ Bromoethane n-Butane **b) Friedal-Craft's alkylation reaction.**  	
Q.16.	Answer the following: (a) State Pauli's exclusion principle. **Only two electrons may exist in the same orbital and these electrons must have opposite spin** (b) Write the designation of the orbital with the following quantum number: **n = 3, l = 2 and n=2 , l =1** **3d 2p**	(2)
Q.17.	Calculate ΔH for the following reaction $N_2(g) + 2O_2(g) \rightarrow 2NO_2(g)$; ΔH = ___?___ KJ/mol This reaction takes place in two steps as follows : In the first step **Nitrogen** reacts with **oxygen** to produce **Nitric oxide** $N_2(g) + O_2(g) \rightarrow 2NO(g)$; $\Delta H_1 = +180$ KJ/mol In the second step **NO** formed reacts with more oxygen to produce NO_2 $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$; $\Delta H_2 = -112$ KJ/mol Ans: **Step-I+ Step-II** gives us the required equation Therefore according to Hess's law we have $\Delta H = \Delta H_1 + \Delta H_2$ $\Delta H = +180 + (-112)$ KJ/mol $\Delta H = (+180 - 112)$ KJ/mol $\Delta H = +68$ KJ/mol	(2)
Q.18	On the basis of Le Chatelier's Principle explain, a) How the temperature and pressure can be adjusted to increase the yield of ammonia in the following reaction? $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$: $\Delta H = -92.38$ kJmol $^{-1}$ Ans: **Effect of temperature**: The reaction is exothermic, hence it will shift in forward direction by lowering the temperature. Thus, better yield of ammonia will be obtained at low but moderate temperature, otherwise reaction will become very slow. **Effect of pressure:** $\Delta ng = 2 - 4 = -2$ **. Volume is decreasing in forward direction; hence it will shift in forward direction, on increasing the pressure.** **Effect of inert gas addition:** At constant volume, there is no effect of addition of Argon.	(2)

b) What will be the effect of addition of argon to the above reaction mixture at constant volume.
There will be **NO effect of addition of argon** to the above reaction mixture at constant volume.

Q.19 A balloon is blown up at 5 ˚C has a volume of 480mL.The maximum volume capacity of the balloon is 548.6mL.will the balloon burst if it is brought to a room having temperature of 30˚C? (2)

T_1= 5 ˚C =278 K , V_1= 480mL. T_2= 30˚C=303 K , V_2=?

V1/T1=V2/T2

480/278=V2/303

V2=523.16 ml

Since the maximum capacity of the balloon is **548.6**mL, the **balloon will not burst at 30˚C as it will occupy volume of only 523.16 ml at this temperature.**

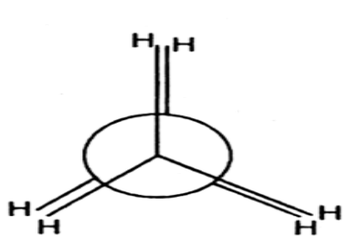
Section-C

Q.20 a) Distinguish between saturated and unsaturated hydrocarbons. (3)

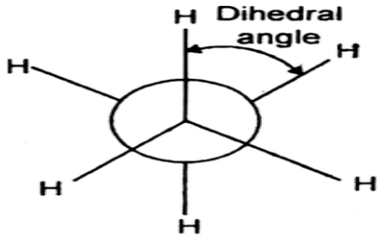
Saturated hydrocarbons	Unsaturated hydrocarbons
These are the organic compounds in which C-C and C-H singe bonds are present.	These are the organic compounds in which C-C multiple bonds are present i.e. double or triple bond or both.

b) Draw the following:

i) Newmann projection formula for staggered and eclipsed conformation of ethane molecule.

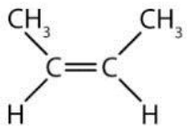


(i) Eclipsed (Newman projection)

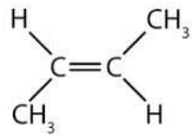


(ii) Staggered (Newman projection)

ii) Geometrical isomers of **But-2-ene.**



cis-2-butene

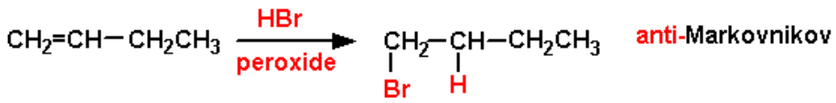


trans-2-butene

Q.21 a) Why does branched chain alkanes have lower boiling point than straight chain alkanes? (3)

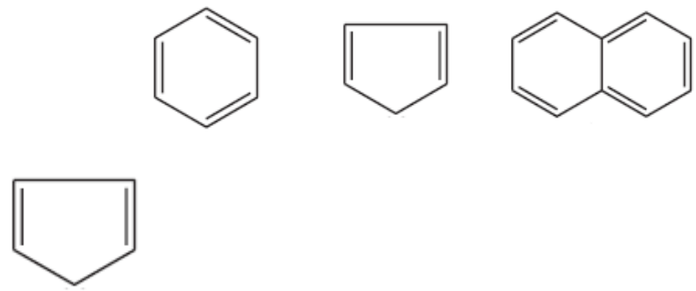
Branched chain alkanes have lower boiling point than straight chain alkanes due to the fact that with the increase in number of branched chain the molecule attains the shape of a sphere. This results in smaller area of contact therefore weak intermolecular forces between spherical molecules.

b) Name the major product obtained on reaction of hydrogen bromide with **butene** in presence of peroxide.



1-bromobutane

c) Identify which of the following is **not** an aromatic compound and write its **name**.



Ans: Name: **Cyclopentadiene (***not fully conjugated, one C is* ***sp³*** *hybridized)*

Q.22 Write the IUPAC nomenclature for the following compounds: (3)

(i) $CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH_2-CH_3$ **Pentan-2-ol**

(ii) $CH_3-\underset{\underset{CH_3}{|}}{CH}-\overset{\overset{O}{\|}}{C}-OH$ **2-methyl propanoic acid**

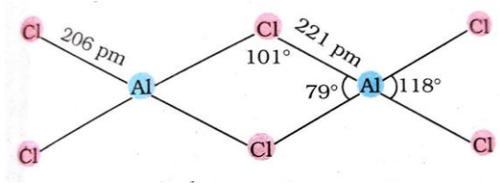
(iii) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$ **Butan-2-one**

Q.23 With respect to **Boron family** answer the following questions. (3)

a. Why BF_3 behaves as a lewis acid.

Boron is electron deficient and can accept electrons hence behave as a lewis acid.

b. Draw the dimeric structure of Aluminum chloride.



c. Complete the following equation

$2Al_{(s)} + \underline{2NaOH}_{(aq)} + 6H_2O_{(l)} \rightarrow \quad 2\,Na^+[Al(OH)_4]^-_{(aq)} + \underline{3H_2}_{(g)}$

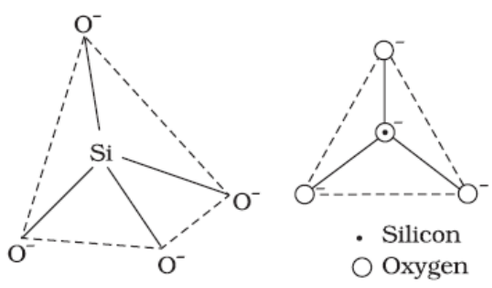
OR

Q.23 With respect to **Carbon family** answer the following questions (3)

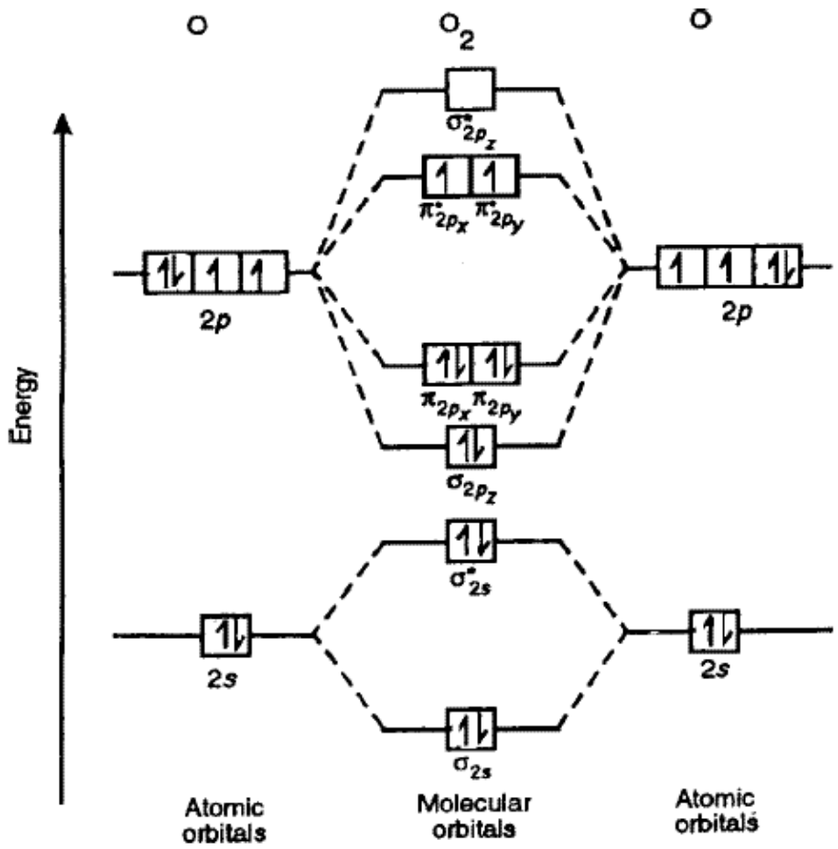
a. Write a point of difference between Graphite and Diamond with respect to type of hybridisation the carbon atom has undergone.

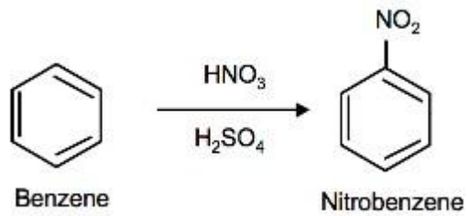
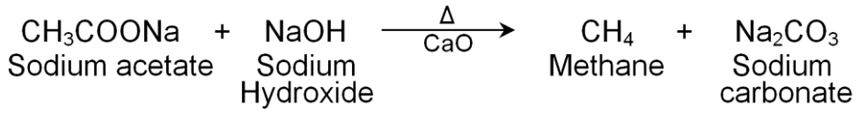
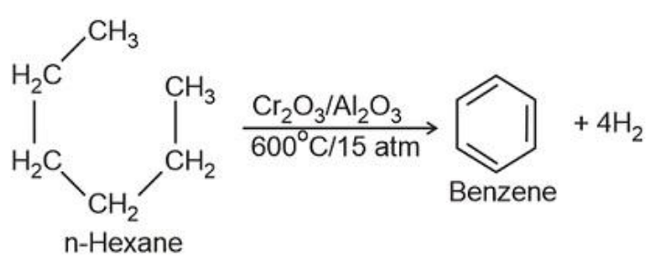
Graphite sp^2 hybridised and diamond sp^3 hybridised

b. Draw the basic structural unit of silicates is SiO_4^{4-}

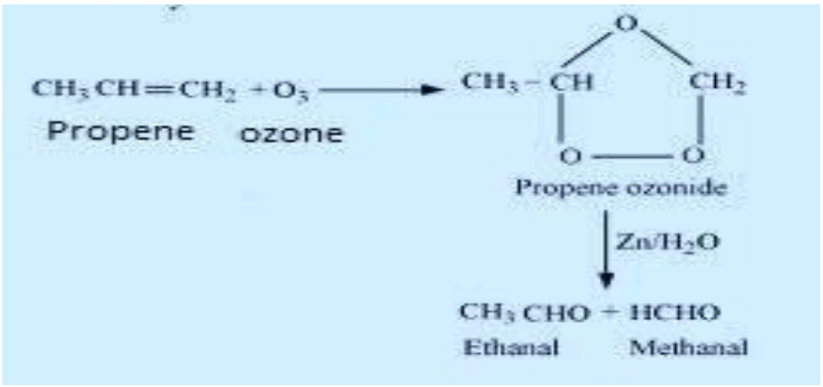


(a) Tetrahedral structure of SiO_4^{4-} anion; (b) Representation of SiO_4^{4-} unit

	c.Complete the following equation **$CaCO_3$ + <u>2 HCl</u> → $CaCl_2$ + <u>CO_2</u> + H_2O**	
Q.24	Define the following **a) Isolated System.** A system in which there is no exchange of **energy nor matter** between the **system** and the **surroundings** **b) Standard enthalpy of sublimation** Standard enthalpy of sublimation, $\Delta subH^0$ is the **change in enthalpy** when one mole of a solid substance sublimes at a constant temperature and under standard pressure (1bar). **c) Entropy of the system** Entropy can be thought of as a measure of the **randomness of a system**. **OR** **Entropy** is the measure of the **disorder** of a system.	(3)
Q.25	(a) Write the hybridisation of sulphur in SF_6 and comment on its geometry. **Sp^3d^2** hybridised . **octahedral geometry** (b) Draw the Molecular Orbital diagram for O_2 molecule. Also find its bond order and comment on its magnetic character.  Bond order (B.O.) = (No. of electrons in BMO - No. of electrons in ABMO)/ 2 **Bond order**= 8-4/2 =2 **Double bond.** **Magnetic character** : two unpaired electrons **Paramagnetic**	(3)
	<u>Section-D</u>	
Q.26	a)Define Buffer solutions A solution which **resists changes in pH** when **dilute acid or alkali** is added to it is called as buffer solution b) Give a point of difference between homogeneous equilibrium and heterogeneous equilibrium. **homogeneous equilibrium:** The reactans and the products are in same phase when the system is in equilibrium	(4)

	heterogeneous equilibrium: The reactans and the products are in different phase when the system is in equilibrium c) For the following reaction, Kc = 4.8×10^{-31} and Qc = 3.8×10^{-38} at 298 K . Predict the direction of the reaction. $$N_2(g)+O_2(g)\rightleftharpoons 2NO(g)$$ The direction of the reaction: The reaction proceeds towards formation of products/towards Right as Qc value is less than Kc d) Write the reaction showing the Amphoteric nature of water. $$H_2O + H_2O \rightarrow OH^- + H_3O^+$$ **OR**	
Q.26	a) Define **ionic equilibrium.** Ionic equilibrium: is the **equilibrium** established between the unionized molecules and the **ions** in a solution. b) Give a point of difference between **lewis acid** and **lewis base.** **lewis acid** :Substances which **lack electrons** or are **electron deficient**, eg BF_3,$AlCl_3$ etc A **Lewis** acid is therefore an electron-pair acceptor. **lewis base** : Substances which **are electrons** rich for e.g **OH^- ,NH_3, H_2O** etc A **Lewis** base is therefore an electron-pair donor. c) $I_2(g)+H_2(g)\rightleftharpoons 2HI(g)$ For the following reaction, Kc = 57.0 ,at 500 K. predict the extent of the reaction. The reactants and the products are **almost in an equilibrium** d) Write the formula for the ionic product of water. Ionic product of water: **$Kw= [H^+][^-OH]$**	(4)
Q.27	Write the chemical equation for each of the following: a**) Nitration of benzene**  b) **Decarboxylation of sodium acetate**  c) **Aromatisation of n-hexane**  	(4)

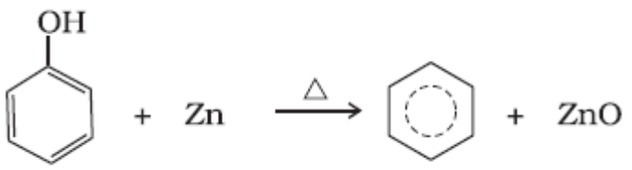
d) **Ozonolysis of propene**



OR

Q.27 Complete the following and write product A and B.

a)



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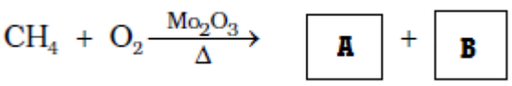
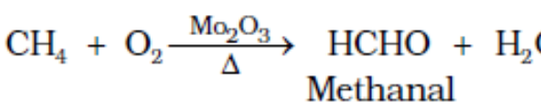
b)





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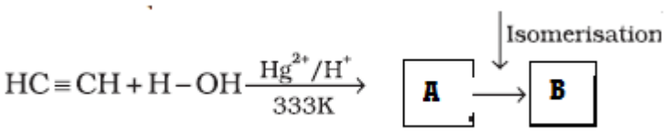
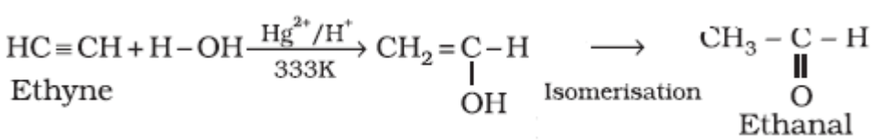
c)





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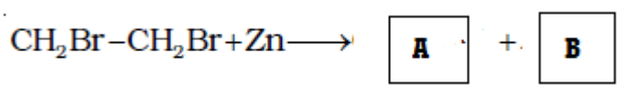
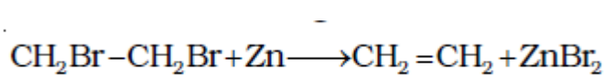
d)





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