



G.C.E. A/L Examination June - 2018

Conducted by Field Work Centre, Thondaimanaru

In Collaboration with

Provincial Department of Education Northern Province.

Chemistry IIA

Grade :- 13 (2018)

Time :- Three hours

Part II A Structured Essay

Answer all questions.

01. (A) Arrange the following in the ascending order of the properties given in parentheses.

(i) H_2O_2, HF, NH_3, H_2O (boiling point)

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(ii) $OH^-, NH_2^-, CH_3O^-, HCO_3^-$ (basic nature)

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(iii) $Na_2CO_3, BeCO_3, (NH_4)_2CO_3, BaCO_3$ (thermal stability)

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(iv) $NH_2^-, NH_2^+, NO_3^-, NH_3$ (bond angle)

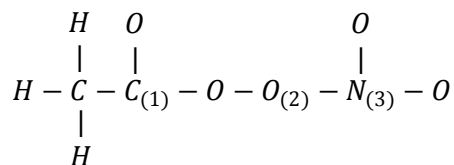
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(v) $CO, CO_2, CO_3^{2-}, C_2O_4^{2-}$ (C-O bond length)

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(B) Motor vehicle emissions contain NO_x and Unburnt hydrocarbons (C_xH_y). They are converted to ozone and peroxyacetyl nitrate in the presence of sunlight and temperatures above $15^\circ C$

The skeleton of the PAN molecule is given below



(i) Draw the most acceptable Lewis structure for PAN molecule

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(ii) Draw four resonance structures of PAN and comment on their relative stabilities

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(iii) Complete the following table with regard to the Carbon, Oxygen and nitrogen atoms indicated by $C_{(1)}$, $O_{(2)}$, and $N_{(3)}$, in the Lewis structure

Atom	Hybridization	Electron pair geometry around the atom	Shape
$C_{(1)}$			
$O_{(2)}$			
$N_{(3)}$			

i). Identify the atomic / hybrid orbitals involved in the formation of sigma bond between the following atoms in the Lewis structure drawn in part (i) above

i. Between $C_{(1)}$ and O atom joined with O

..... of $C_{(1)}$ and of O

ii. Between $C_{(1)}$ and C

..... of $C_{(1)}$ and of C

iii. Between $O_{(2)}$ and $N_{(3)}$

.....of $O_{(2)}$ and of $N_{(3)}$

iv. Draw the shape of the PAN molecule indicating the approximate bond angles

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(C) State whether the following statements are true or false giving reasons briefly for your choice (Although the)

(i) Although the reactivity of alkaline metals increases down the group, reactivity of halogens decreases down the group

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(ii) The increasing order of the covalent character of the compounds $MgBr_2, CaCl_2, BaF_2$ and $BaCl_2$ is $MgBr_2 < CaCl_2 < BaCl_2 < BaF_2$

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(iii) The first electron affinity of carbon is negative while that of N is Positive

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(iv) The melting point of Zn is much higher than that of Co.

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02. (A) Q,R and T are three consecutive, non transition elements in the periodic table. R forms more than one oxide. These oxides are either acidic or neutral. R never forms basic oxide. One of the above oxides undergoes disproportionation with water . One of the Hydrides of R which is basic is used in rubber industry.

(i) Identify the above mentioned elements Q, R and T

Q = R = T =

(ii) Write balanced equation for the disproportionation reaction of the oxide with water

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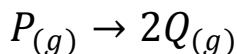
(iii) Write balanced equation for the reaction of the oxide of R in its highest oxidation state with $NaOH_{(aq)}$

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(iv) Another hydride of R, not mentioned in the question, may show acidic nature. Give the formula and the name of it.

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03. (A) When 0.020 moles of gas P was placed in an evacuated rigid vessel at 1.0 dm^3 volume at 127°C in the presence of a small amount of a solid catalyst, it decomposed according to the equation.



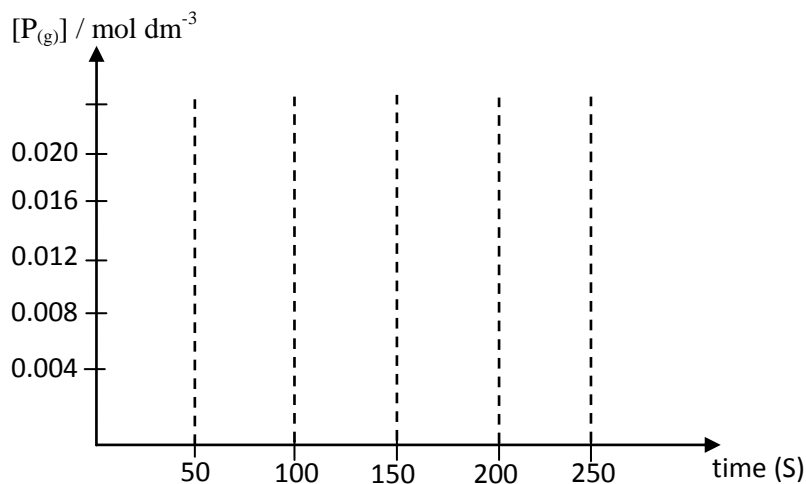
The concentration of $Q_{(g)}$ with time was measured and the results were tabulated.

Time/s	$[Q] / \text{mol dm}^{-3}$
0.0	0.000
50.0	0.008
100.0	0.016
150.0	0.024
200.0	0.032
250.0	0.040

- i. Calculate the concentrations of P, $[P]$, corresponding to the times mentioned in the above table.

<u>Time/s</u>	<u>$[P_{(g)}] / \text{mol dm}^{-3}$</u>
0.0
50.0
100.0
150.0
200.0
250.0

- ii. Show the variation of $[P_{(g)}]$ with time in the following graph.



- iii. Taking the order and the rate constant of the reaction as n and k respectively, write the expression for the rate law of the reaction.

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- iv. Deduce the value of n using the above graph. Give reasons briefly.

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v. Find the value of the rate constant k at 127°C

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vi. Calculate the pressure inside the vessel at 127°C when 75 % of the initial amount of $P_{(g)}$ has dissociated. [Neglect the volume of the catalyst].

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vii. Mention the temperature and pressure at which the three phases of water co- exist together in equilibrium.

Temperature :-

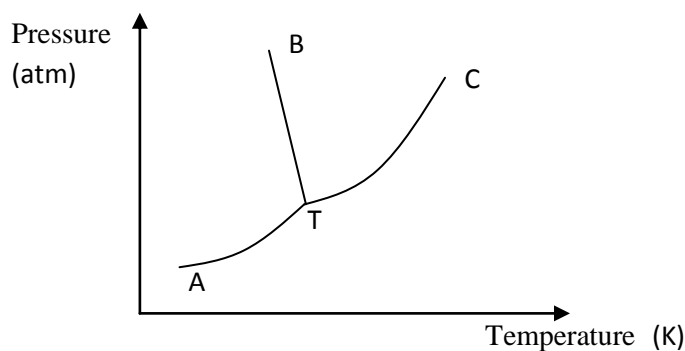
Pressure :-

viii. If the temperature of ice is increased under a pressure below that you mentioned above, state the physical change in it?

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(B) The diagrams indicating the phase changes of a particular substance with temperature and pressure are called phase diagrams .

The phase diagram of water is given below.



i. Indicate the regions of solid, liquid and gaseous phases of water with the letters X,Y and Z respectively in the above phase diagram.

ii. How is the point T called?

What is its significance ?

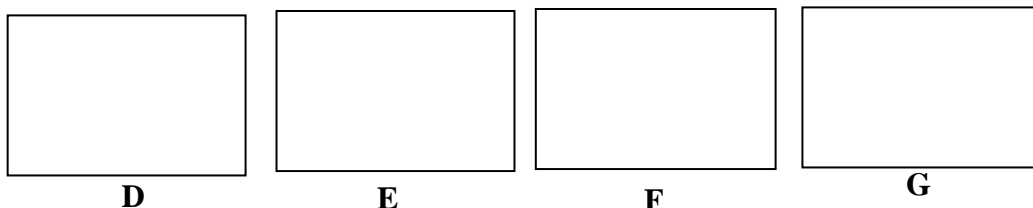
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iii. What is meant by the critical temperature of water?

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04. (A) D, E and F are three compounds with the molecular formula $C_5H_{10}O$, which give orange precipitate with Brady's reagent. All the three compounds D, E and F give the same product G with Zn/Hg, conc. HCl. Of the three compounds, only D exhibits optical activity while only D and E give silver mirror with Tollen's reagent.

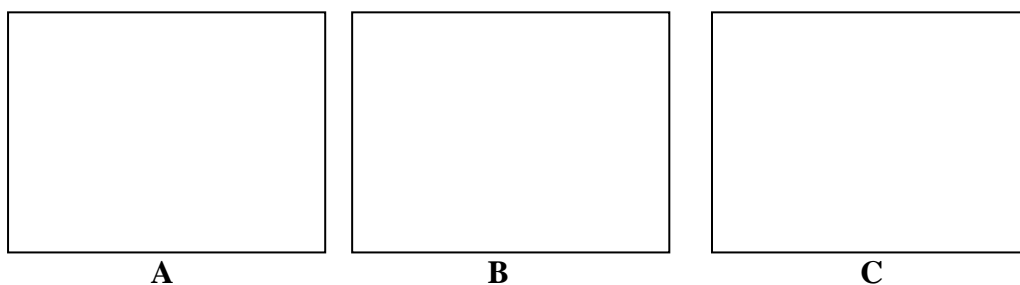
(i) Draw the structures of D, E, F and G in the boxes given below.



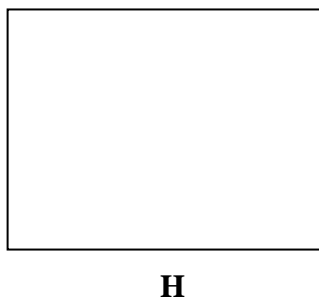
(ii) A, B and C are three structural isomers of D, E and F. Only A gives silver mirror with Tollen's reagent and forms aldol type compound with dilute NaOH

When B and C were treated with $NaBH_4$ separately, only B gave a product having optical activity. When the product obtained from C in the above reaction was treated with Lucas reagent, a turbid was formed after a short time.

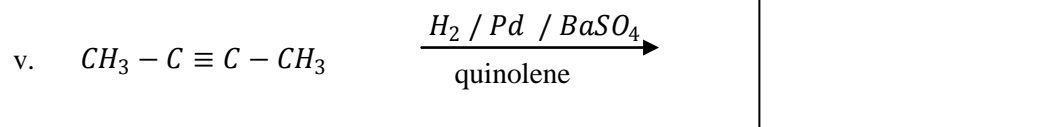
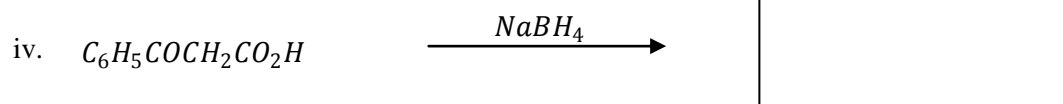
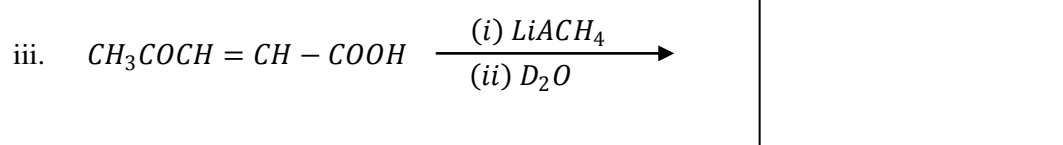
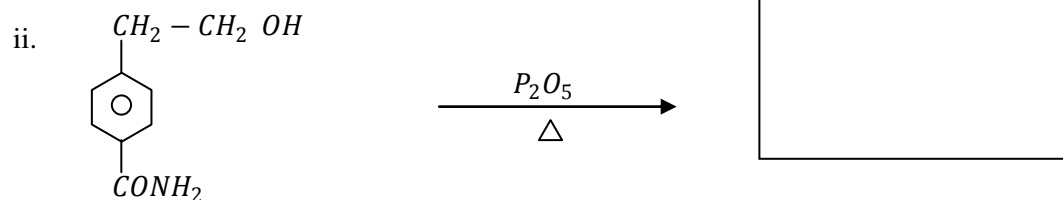
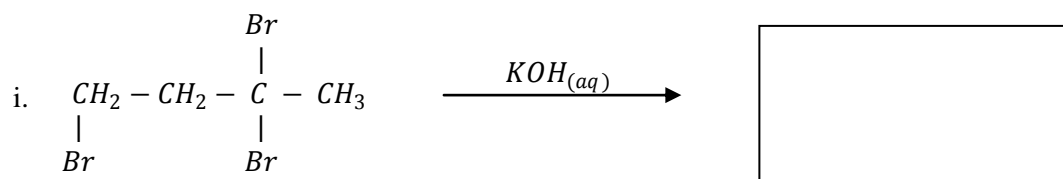
Draw the structures of A, B and C in the relevant boxes given below.



(iii) The above mentioned compounds A, D and E have another chain isomer H. Draw the structure of H.



(B) Write the products of the following reactions in the cages against them.



(C) Consider the reaction of $\text{C}_6\text{H}_5\text{CHO}$ with $\text{C}_2\text{H}_5\text{ONa}$.

(I) Mention the type of mechanism of the above reaction.

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(II) Write the mechanism for the above reaction.

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