Conducted by Field Work Centre, Thondaimanaru
In Collaboration with Provincial Department of Education
Northern Province
Term Examination, November - 2019

FWC

| Grade – 13 (2020)	Chemistry I	Time : 2 Hours

Part I

1. The number of unpaired electrons present in a gaseous Cr^{3+} ion in its ground state is
   1. 5   2. 4   3. 3   4. 6   5. 2

2. Elements that quantum number set *(3, 1, 1,+1/2)*, (4, 0, 0, +1/2) relevant to electron in the last sub. energy levels are respectively.
   1. Al and Zn   2. Na and Ca   3. Mg and K
   3. Al and Sc   5. Mg and Ca

3. What is the IUPAC name of the following compound

$$HO - CH_2 - CH = CH - \overset{\overset{\displaystyle O}{\|}}{C} - CH_2 - CH_2 - NH_2$$
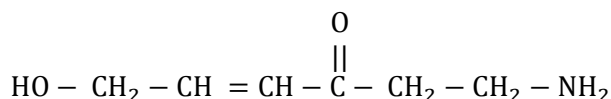
   1. 6 – hydroxy – 1 – aminohex – 4 – en – 3 – one
   2. 1 – amino – 6 – hydroxyhex – 4 – en – 3 – one
   3. 1 – ammine – 6 – hydroxyhex – 4 –en – 3 – one
   4. 1 – amino – 6 – hydroxo – 4 – en – 3 – one
   5. 6 – hydroxo – 1 – aminohex – 4 – en – 3 – one

4. The number of stable resonance structures that can be drawn for the asymmetric dinitrogen trioxide (N_2O_3) molecule is
   1) 3   2. 4   3. 1   4. 2   5. 5

5. The molarity ($moldm^{-3}$) of a $NaNO_3$ solution which has a density of $2.21gcm^{-3}$ and 5% $NaNO_3$ by mass is
   (Na = 23, N = 14, O = 16)
   1. 0.13   2. 13   3. 1.71   4. 17.1   5. 1.3

6. What is the increasing order of the rate of reaction of the compounds P, Q, R, and S when taking part in electrophilic substitution reaction
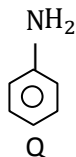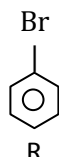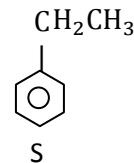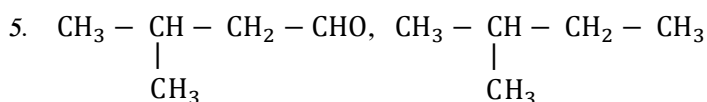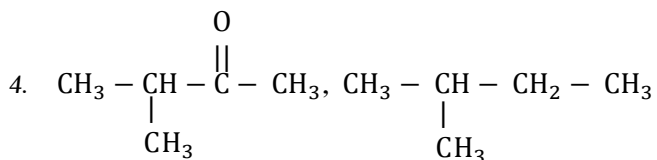

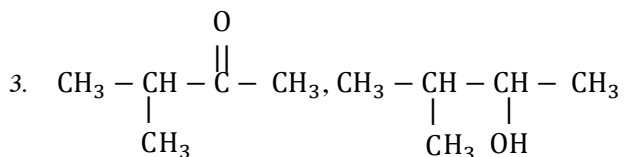   1. R < P < S < Q   2. P < R < S < Q   3. P < S < R < Q
   4. R < S < P < Q   5. S < R < P < Q

7. In the reaction sequence given below the structure of A and B respectively are

$$CH_3 - \underset{\underset{CH_3}{|}}{CH} - C \equiv CH \xrightarrow{\ Hg^{2+}/diluted\ H_2SO_4\ } A \xrightarrow[(2)\ H^+/H_2O]{(1)\ LiAlH_4} B$$

1. $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CHO,\ CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CH_2 - OH$

2. $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CHO,\ \ CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - COOH$

3. $CH_3 - \underset{\underset{CH_3}{|}}{CH} - \overset{\overset{O}{||}}{C} - CH_3,\ CH_3 - \underset{\underset{CH_3}{|}}{CH} - \underset{\underset{OH}{|}}{CH} - CH_3$

4. $CH_3 - \underset{\underset{CH_3}{|}}{CH} - \overset{\overset{O}{||}}{C} - CH_3,\ CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CH_3$

5. $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CHO,\ CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CH_3$
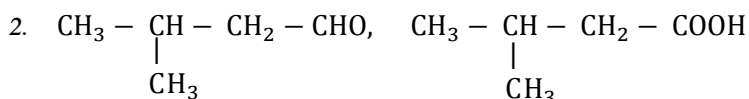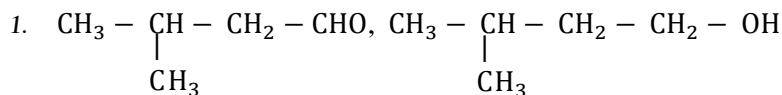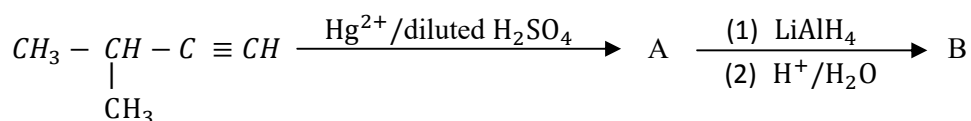
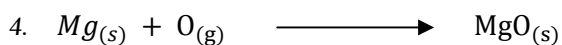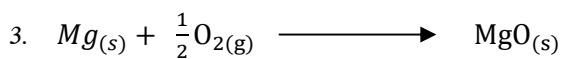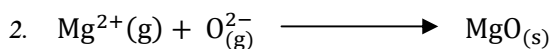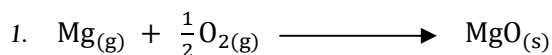8. The enthalpy change of which of the following chemical reactions corresponds to the standard enthalpy of formation of MgO?

1. $Mg_{(g)} + \frac{1}{2}O_{2(g)} \longrightarrow MgO_{(s)}$

2. $Mg^{2+}(g) + O^{2-}_{(g)} \longrightarrow MgO_{(s)}$

3. $Mg_{(s)} + \frac{1}{2}O_{2(g)} \longrightarrow MgO_{(s)}$

4. $Mg_{(s)} + O_{(g)} \longrightarrow MgO_{(s)}$

5. $2Mg_{(s)} + O_{2(g)} \longrightarrow 2MgO_{(s)}$
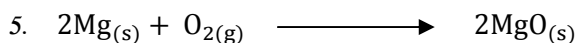
9. Which of the following statement is not true regarding ideal gas
   1. molecular collisions are elastic
   2. molecules move randomly in straight lines at the same speed.
   3. There are no attractive or repulsive forces between molecules.
   4. Size of gas molecule is negligibly small compared to the distance between them
   5. The average value of the kinetic energies of molecules depends on temperature.

10. Which of the following gives mixture of two acids when react with water
    1. CO_2 2. SO_2 3. N_2O_5 4. PCl_3 5. NCl_3

11. Which is the correct relation to the reaction given below

    $$2KMnO_{4(aq)} + 3H_2SO_{4(aq)} + 5H_2S_{(g)} \longrightarrow K_2SO_{4(aq)} + 5S_{(s)} + 2MnO_{4(aq)} + 8H_2O_{(l)}$$
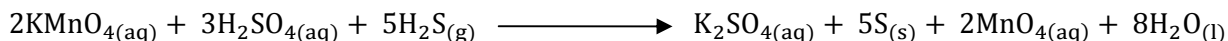
    1. $\dfrac{2\Delta\,[KMnO_{4(aq)}]}{\Delta t} = \dfrac{5\Delta\,[H_2S_{(g)}]}{\Delta t}$

    2. $\dfrac{2\Delta\,[KMnO_{4(aq)}]}{\Delta t} = \dfrac{\Delta\,[H_2S_{(g)}]}{\Delta t}$

    2. $\dfrac{\Delta\,[KMnO_{4(aq)}]}{\Delta t} = \dfrac{5\Delta\,[H_2S_{(g)}]}{\Delta t}$

    4. $\dfrac{3\Delta\,[KMnO_{4(aq)}]}{\Delta t} = \dfrac{\Delta\,[H_2S_{(g)}]}{\Delta t}$

    5. $\dfrac{5\Delta\,[KMnO_{4(aq)}]}{\Delta t} = \dfrac{2\Delta\,[H_2S_{(g)}]}{\Delta t}$

12. A salt containing one type anion gives a coloured gas when reacted with dil HCl. This gas undergo dispropotination reaction with suitable anion
    1. NO_3^- 2. SO_3^{2-} 3. NO_2^- 4. SO_4^{2-} 5. $S_2O_3^{2-}$

13. Which of the following statement is false with regard to the chemistry of Chromium
    1. The common and stable oxidation states of chromium are +3 and +6
    2. Acidity of the chromium oxides increase with the increasing number of oxidation of chromium
    3. The melting and boiling point of chromium is considerably high value.
    4. In normal condition chromium ion does not form complex conc. ammonia
    5. The colour of $[CrCl_6]^{3-}$ is yellow.

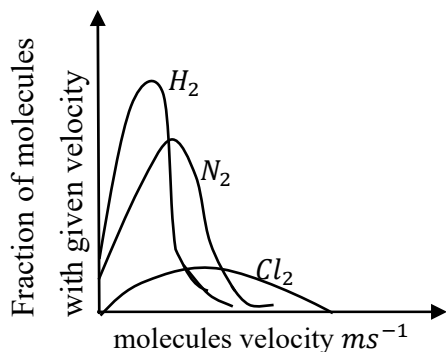14. Which of the following compounds on heating will produce $N_{2(g)}$ as one of the products?

    1. NH_4NO_3 2. $(NH_4)_2CO_3$ 3. $(NH_4)_2SO_4$

    4. NH_4NO_2 5. NH_4Cl

15. Molecular velocity of two gases at same temperature are C_1 and C_2 and their masses are m_1 and m_2 respectively. Which relation is correct
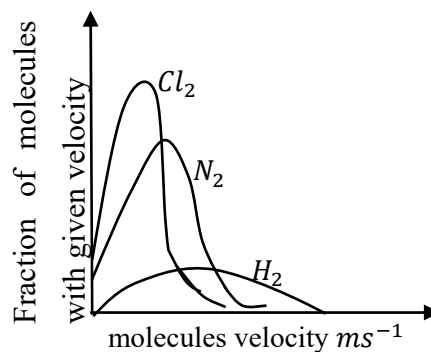
    1. $m_1C_1{}^2 = m_2C_2{}^2$ 2. $\dfrac{m_1}{C_1^2} = \dfrac{m_2}{C_2^2}$ 3. $\dfrac{m_1}{C_1} = \dfrac{m_2}{C_2}$

    4. $m_1C_1 = m_2C_2$ 5. $\dfrac{m_1}{C_1} = \dfrac{1}{3}\dfrac{m_2}{C_2}$

16. Which one specify the correct maxwell – Boltzmann speed distribution graph of the three gases $Cl_{2(g)}, N_{2(g)}$ and $H_{2(g)}$ at 300 K

1)

2)

3)

4)

5)

17. $CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(l)}$ $\Delta H_f^\theta = -890 kJmol^{-1}$

    $H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)}$ $\Delta H_f^\theta = -286 kJmol^{-1}$

    $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H_f^\theta = -394\ kJmol^{-1}$
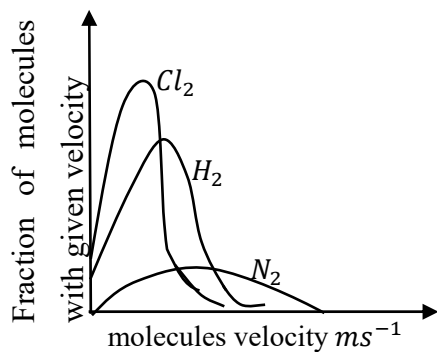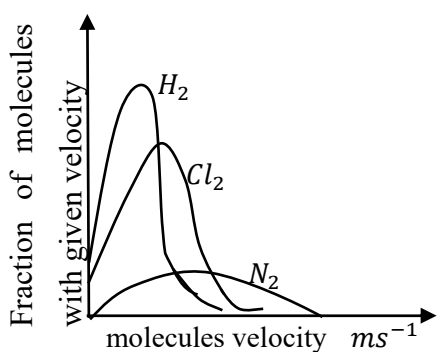
using the above give data. Calculate the enthalpy change of the following reaction

    $C_{(s)} + 2H_{2(g)} \longrightarrow CH_{4(g)}$
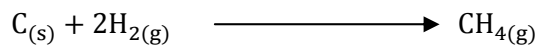
1. + 76   2. + 68   3. - 76   4. - 68   5. - 58

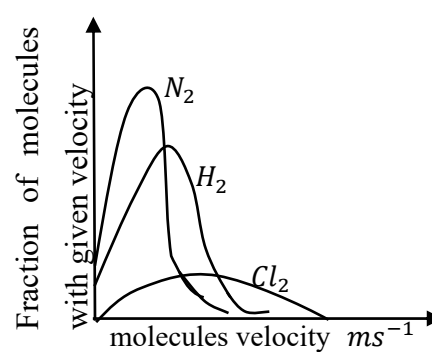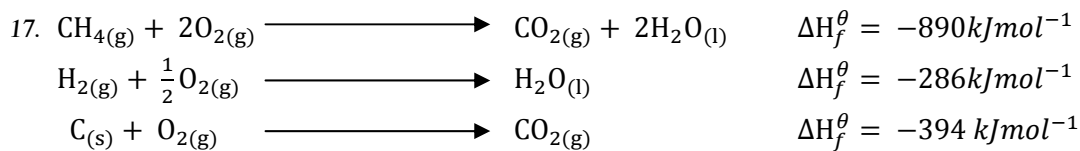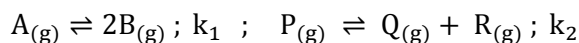18. What is the mass of 60% $KClO_3$ sample, to produce $48g$ O_2 gas. (K = 39, Cl = 35.5, O = 16)

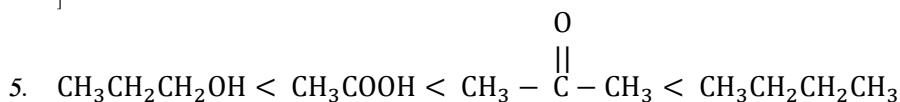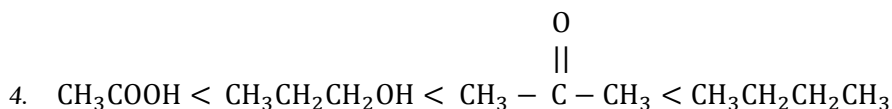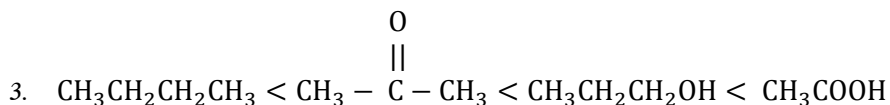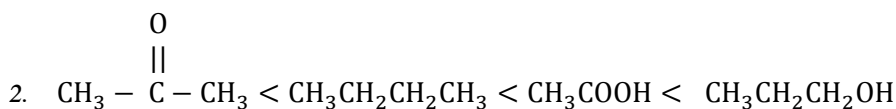   1. 18.75   2. 112.5   3. 11.25   4. 1125   5. 187.5

19. Consider the following equilibriums and its equilibrium constant k_p. Initially 2.0 mol of each A and P are present in two different rigid containers. .

$$A_{(g)} \rightleftharpoons 2B_{(g)} ; k_1 ; \quad P_{(g)} \rightleftharpoons Q_{(g)} + R_{(g)} ; k_2$$

The ratio of $k_1 : k_2$ is 1 : 5 . The degree of dissociation of two reactions is equal Ratio of the total pressure at these equilibrium is

    1. $1 : 20$ 2. $1 : 1$ 3. $1 : 15$ 4. $1 : 24$ 5. $1 : 18$

20. Which of the following **does not occur** when the atomic number of the elements increase in group 17 of the periodic table.

    1. Acidity of oxyacids increases.

    2. Oxidation property increases.

    3. Boiling temperature of the molecules increases

    4. Reactivity decreases.

    5. Pauling's value of this elements decrease.

21. Which arrangements of compounds given below gives the correct increasing order of boiling points?

    1. $CH_3CH_2CH_2CH_3 < CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3 < CH_3COOH < CH_3CH_2CH_2OH$

    2. $CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3 < CH_3CH_2CH_2CH_3 < CH_3COOH < CH_3CH_2CH_2OH$

    3. $CH_3CH_2CH_2CH_3 < CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3 < CH_3CH_2CH_2OH < CH_3COOH$

    4. $CH_3COOH < CH_3CH_2CH_2OH < CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3 < CH_3CH_2CH_2CH_3$

    5. $CH_3CH_2CH_2OH < CH_3COOH < CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3 < CH_3CH_2CH_2CH_3$
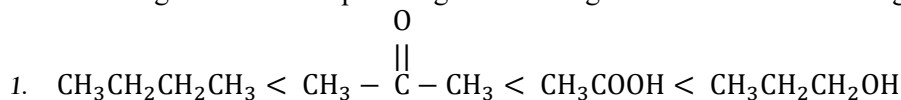
22. Consider a reaction $A_{(g)} \longrightarrow B_{(g)} + C_{(g)}$. If the mitial concentration of A was reduced from 2 moldm^{-3} to 1 $moldm^{-3}$ in 1 hour and the from 1 $moldm^{-3}$ to 0.25 $moldm^{-3}$ in 2 hours, the order of the reaction is

    1. 1   2. 0   3. 2   4. 3   5. all are wrong

23. The type of hydride orbital of Cl atom in ClO_2^- is

    1. SP^3 2. SP^2 3. SP   4. d^2SP^3 5. all are wrong

24. For the precipitation of silver chloride from Ag^+ ions with NaCl solution what is correct?

    1. ΔH is zero for the reaction

    2. ΔH is equal to ΔG

    3. ΔG is greater than zero

    4. ΔG is zero for the reaction

    5. ΔG is less than zero for the reaction

25. The increasing order of the first ionization energy of atoms N, O, F, Cl and Ar is

    1. O < N < F < Cl < Ar   2. Cl < O < N < F < Ar

    3. Cl < O < N < Ar < F   4. O < Cl < N < Ar < F

    5. O < Cl < N < F < Ar

26. Which of the following statements regarding chemical equilibrium is not true?

    1. When a chemical reaction is in equilibrium, the rate of consumption of reactants and the rate of formation of products are always equal.

    2. Under standard conditions equilibrium constants do not have units.

    3. Before attaining equilibrium, if $\Delta G < 0$ and $Q < K$, then the reaction proceeds in the forward direction.

    4. Equilibrium constants are a measure of the equilibrium position.

    5. If $10^{-3} < K_c$, reactants will be in higher amount than produce.

27. Which one of the following is the correct statements?

    1. Phenol undergoes friedal crafts alkylation and easily produces ortho, Para products.

    2. Nitro benzene does not undergo friedal crofts alkylation.

    3. Only aldehydes and ketones have carbonyl (c=o) group.

    4. Phenol is a monohydric alcohol.

    5. Phenoxide ion is more stable than carboxylate

28) The reaction $\quad 2A + B \longrightarrow C + D$ takes place through the following steps.

$$2A \underset{K_r}{\overset{K_f}{\rightleftharpoons}} A_2 \qquad \text{(fast)} \quad K_f \text{ - constant of rate of forward reaction}$$

$$A_2 + B \longrightarrow C + D \qquad \text{(slow)} \quad K_r \text{ - constant of rate of backward reaction}$$
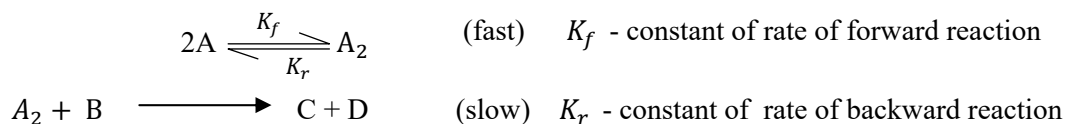
Which one of the following relationship is incorrect?

1. Rate of forward reaction $\quad = K_f\,[A]^2$

2. Rate of reverse reaction $\quad = K_r\,[A_2]$

3. At equilibrium $\quad K_f\,[A]^2 = K_r\,[A_2]$

4. Rate of reaction $\quad = K_f[A]^2[B]$

5. $K = \dfrac{K_r}{K_f}$

29) Temperature versus time graph for a solid substance X is given below.
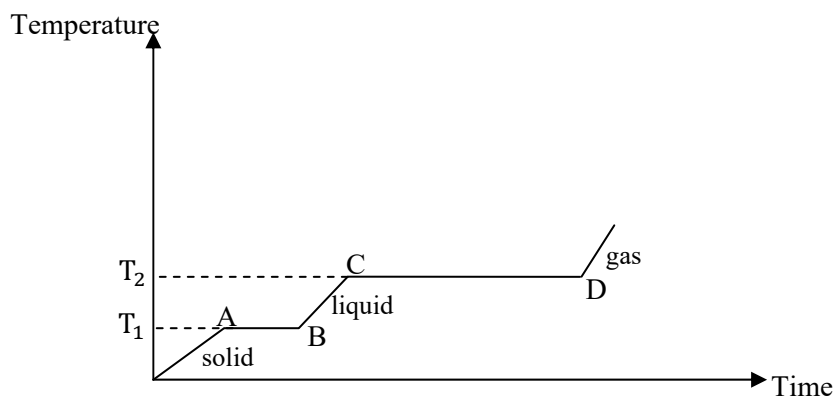
Which one is the false statement?

1. For this substance, $[\Delta H_{fusion}] < [\Delta H_{vapounzation}]$

2. The melting point of the substance is T_1

3. The boiling point of the substance is T_2

4. The portion CD of the graph represents vapourization of substance X.

5. Vapourization of X is sooner than it melting

30) The correct statement regarding some P – block elements and their compounds is

1. +7 oxidation state is very stable for bromine

2. NH_3 can act only as a base

3. The reaction of SCl_2 with water results in the formation of H_2SO_3, S, HCl

4. Xenon (Xe) can take only +2, +4 and +6 oxidation states.

5. In the lewis structure of CO, the octet state is not complete.

❖ **For each of the question 31 to 40 one or more response out of four responses (a), (b), (c) and (d) given is / are correct. Select the correct responses / responses. In accordance with the instruction given on your answer sheet mark.**

1	2	3	4	5
Only (a) (b) are correct	Only (b) (c) are correct	Only (c) (d) are correct	Only (a) (d) are correct	The other numbers correct

31) The following graph shows how the amount of product changes with pressure and temperature which of the reaction / s are relevant to the given graph?
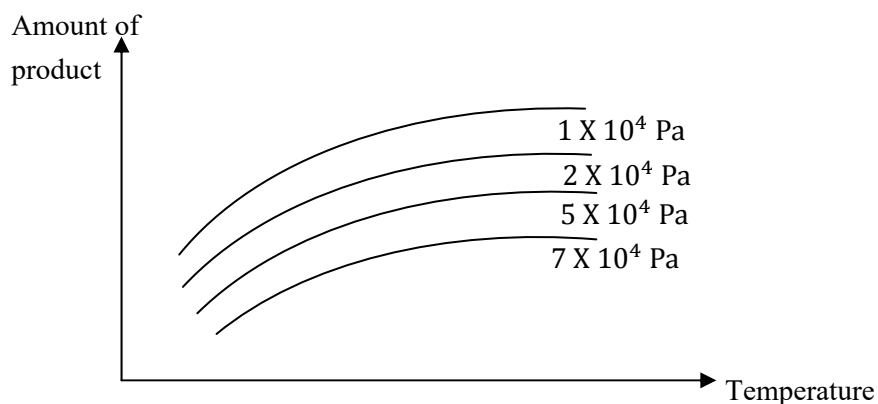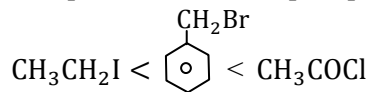

(a) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ $\Delta H > 0$

(b) $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$ $\Delta H > 0$

(c) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$ $\Delta H > 0$

(d) $SbCl_{3(g)} + Cl_{2(g)} \rightleftharpoons SbCl_{5(g)}$ $\Delta H < 0$
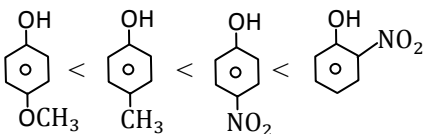
32) The correct statement / s regarding 3d – elements is / are

(a) Atomic radius decrease from Sc to Ni.

(b) All the elements form stable cations with more than one oxidation states.

(c) Aqueous solutions of many transition metal cations absorb radiation in the visible region of electro magnetic spectrum and hence produce several colours.

(d) Cu has the highest second ionization energy.

33) Which of the following represent / s the correct order of the property mentioned in each.

(a) The speed with which a precipitate is formed wih an aqueous solution of $AgNO_3$

$$CH_3CH_2I < \underset{}{\text{(benzyl bromide, }CH_2Br)} < CH_3COCl$$

(b) Acidity :-

$$\underset{OCH_3}{\overset{OH}{\bigcirc}} < \underset{CH_3}{\overset{OH}{\bigcirc}} < \underset{NO_2}{\overset{OH}{\bigcirc}} < \overset{OH}{\underset{}{\bigcirc}}NO_2$$

(c) Boiling point :- $CH_3CH_2Cl < CH_3CHO < CH_3COCH_3 < HCOOH$

(d) Basicity :- $CH_3CONH_2 < NH_3 < (CH_3)_3N < (CH_3)_2NH$

34) The incorrect statement / s regarding gases is / are

(a) At 0^0C and under a pressure of 1 bad, the molar volume of an ideal gas is 22.41 dm^3mol^{-1}

(b) At a given time, number of collisions on the container wall is directly proportional to the density of the

(c) The minimum temperature at which a gas can be liquefied is called the critical temperature.

(d) Compressibility factor Z given by $Z = \dfrac{V_{ideal}}{V_{real}}$ where

$(V_{ideal} -$ molar volume when it behavior ideally.

$V_{real} -$ molar volume true regarding quantum)

35) The statement / s which are true regarding quantum numbers is / are

(a) The maximum number of electrons associated with n = 3 is nine.

(b) The number of electrons having a value 2 for the quantum number which determines the shape of the orbital in Cu^+ ion is 10.

(c) The set of orbitals with the same value for n and l is called the sub shell.

(d) Filling of electrons in the increasing order of the principal quantum number always minimizes the energy of the atom .

36) Which of the statements given below regarding thermo chemistry is / are true?

(a) standard state is defined as the pressure of 1 atm and concentration $1moldm^{-3}$.

(b) Enthalpy change of a chemical reaction depends on the physical states of reactants.

(c) Kinetic energy, velocity and colour are some of the microscopic properties.

(d) The net stability of a solid, ionic compound depends on the interaction between a cation and anion

37) In a closed vessel, the following reaction exists in equilibrium at a given temperature.

$$2P_{(g)} + R_{(s)} \rightleftharpoons Q_{(g)} + S_{(g)}$$
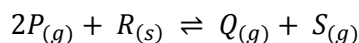
The activation energy of the forward reaction is 750 KJmol^{-1} and that of the backward reaction is 550 KJmol^{-1}.

The correct statement / statements regarding the above system.

(a) When the temperature is increased, the amount of $Q_{(g)}$ will increase.

(b) If the temperature is increases rate of forward reaction increases and the rate of reverse reaction decreases.

(c) If some of the reactant R is removed, the reverse reaction will be facilitated.

(d) Increase in pressure will not affect the equilibrium position.

38) The compound / compounds that show an observable change on addition of water is / are

(a) $BiCl_3$ b) PCl_3 c) SF_6 d) NCl_3

39)
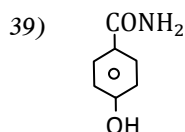
The statement / statements which are correct regarding the compound is / are

(a) It is reduced by $NaBH_4$ and gives $C_6H_5CH_2NH_2$.

(b) It reacts with CH_3COOH to gives an ester.

(c) It liberates N_2 gas when treated with $NaNO_2$ / HCl.

(d) It gives a gaseous product when treated with CH_3mgBr

40) Which of the following statements regarding reaction kinetics is / are correct?

(a) Unit of the rate constant for a second order reaction is $moldm^{-3}S^{-1}$

(b) The value of the rate constant of a reaction does not depend on the initial concentration of reactants and it is a constant at a given temperature.

(c) Molecularity can never be zero

(d) The activated complex formed in a multistep reaction is very stable.

❖ **Instructions for questions 41 – 50.**

Response	First statement	Second statement
1)	True	True and correctly explains the first statement.
2)	True	True, but not explain the first statement correctly
3)	True	False
4)	False	True
5)	False	False

	Statement I	**Statement II**
41)	Cr^{6+} will exist only as $Cr_2O_7^{2-}$ in acidic medium.	In acidic medium, CrO_4^{2-} undergoes dimerization and converted to $Cr_2O_7^{2-}$
42)	When a strongly alkaline solution is diluted, its pH will decrease.	When a weekly basic solution is diluted, its extent of ionization will increase.
43)	Under conditions of constant temperature and pressure, for a spontaneous reaction $G_{r\,x\,n} < 0$	To predict the spontaneity of a reaction, both the enthalpy change and entropy change have to be considered.
44)	Amines are more basic than alcohols.	The stability of alkyl ammonium ion in relation to amine is greater than the stability of alkyl oxonium ion in relation to alcohol.
45)	When an atom of an element forms an ion, it always acquires the electron configuration of S^2P^6	Whenever an atom forms anion, the electrons are occupied in P orbital.
46)	Introduction of an inert gas into any equilibrium system under constant pressure equilibrium constant will shift.	Under all conditions by changing the temperature of the equilibrium systems, the value of equilibrium constants may be changed.
47)	Alkenes and alkynes decolouring Br_2 / CCl_4	All the unsaturated compounds react with Br_2 / CCl_4
48)	To determine the melting point and water solubility of all the compounds, polarizing power and polarizability can be used.	With the increase in charge and the decrease in ionic radius of cation, its polarizing power will increase.
49)	All the molecules of an ideal gas do not move with the same speed.	In an ideal gas inter molecular attractive forces cannot always by neglected
50)	The hydrogen atoms directly attached to the carbon of the carbonyl group have acidic nature	In carbonyl compounds, carbonyl group has a strong electron donating ability