PUBLIC EXAMINATION 2019

CHEMISTRY

QUESTION TYPE B

1.B)First Order

2.A)Diethyl ether

3.A)(ii)and (iii)

4.D)(1)-(iii),(2)-(i),(3)-(iv),(4)-(ii)

5.D)Pentagonal bipyramidal

6.A)4.90BM

7.D)Strong reducing agents

8.C)dynamic

9.C)C_1-C_2

10.C)$ohm^{-1}m^{-1}$

11.C)w-PΔV

12.A)-OH

13.A)Ionic

14.B)C_6H_5NH-NH-C_6H_5

15.D)CH_3COCH_3

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QUESTION TYPE A

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10. D)(1)-(iii),(2)-(i),(3)-(iv),(4)-(ii)

11. D)Strong reducing agents

12. A)Ionic

13. C)dynamic

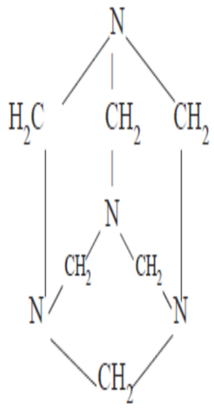
14. A)4.90BM

15. C)ohm^{-1}m^{-1}

16. The higher the nuclear charge of
protons in the nucleus, the higher is the ionization energy.
Because of the higher nuclear charge, the electrons are bound with more force and hence higher energywill be required for their removal.
For instance, magnesium has higher nuclearcharge (12 protons) as compared to sodium (11 protons). Hence ionization energyin case of magnesium is higher as compared to sodium.
17. These elements shows the oxidation states of +2, +3, +4, +5 and +6. Out
of these, +4 oxidation state is most common state.
18. A small quantity of Radioactive CO^*_2 containing radioactive oxygen O^{18} is
mixed with ordinary carbondioxide and the process is carried out.
It has beenfound that oxygen gas evolved along with sugar formation is non-radioactive.
Therefore O_2 produced comes from water and not from carbondioxide. So the
correct mechanism is as follows.

$$6CO^*_2 + 6H_2O \rightarrow C_6H_{12}O^*_6 + 6O_2$$

19. glassy orvitreous state is a condition in which certain substance can exist, lying betweenthe solid and liquid states.
20. Complete reduction of glucose with concentrated hydriodic acid in the
presence of red phosphorous produces
n-hexane as the major product.
This indicates that the six carbon atoms in the glucose molecule form an



This is used as Urinary antiseptic in medicine, in the name of 'Urotropine'.
24.II reaction will go faster then I reaction.This is due to the activation energy is minimum the reaction go faster
25.

$$\text{Electronegativity of fluorine} = \frac{(IP)_F + (EA)_F}{2\times 2.8} = \frac{17.4+3.62}{5.6} = \frac{21.02}{5.6} = 3.75$$

26.

Lanthanides		Actinides	
i)	Binding energies of 4f electrons are higher.	i)	Binding energies of 5f electrons are lower.
ii)	Maximum oxidation satate exhibited by lanthanides is +4 e.g. Ce^{4+}	ii)	Due to lower binding energies they show higher oxidation states such as +4, +5 and +6. Uranium exhibits +6 oxidation state in UF_6 and UO_2Cl_2
iii)	4f electrons have greater shielding effect.	iii)	5f electrons have poor shielding effect.

27. Let 'a' and 'b' be the number of α β particles emitted during the change

$${}_{90}Th^{232} \rightarrow {}_{82}pb^{208} + a\ {}_{2}He^{4} + b\ {}_{-1}e^{0}$$

Comparing the mass numbers,

$$232 = 208 + 4a + b \times 0$$
$$4a = 232 - 208$$
$$= 24$$
$$a = 6$$

Comparing the atomic numbers

$$90 = 82 + 2 \times a + (-1)b$$
$$= 82 + 2a - b$$
$$2a - b = 90 - 82 = 8$$
$$2(6) - b = 8$$
$$b = 12 - 8 = 4$$

Number of α - particle emitted = 6

Number of β - particles emitted = 4

28. 'Q' is defined as the ratio of product of initial concentrations
of products to the product of initial concentrations of reactants under nonequilibrium
conditions. For example, in the equilibrium.

aA + bB ←→ lL + mM

Let [A], [B], [L] and [M] be the actual concentrations present before the
occurrence of equilibrium. These concentrations are considered as the nonequilibrium
concentration conditions and the reaction quotient

$$Q = \frac{[L]^l[M]^m}{[A]^a[B]^b}$$

'Q' is given as

29. (i) It should have a suitable colour.
(ii) It should be able to fix itself or be capable of being fixed to the fabric.
(iii)It should be fast to light.

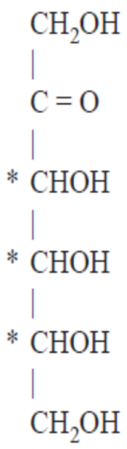
30. The standard emf Eo, of a cell is the standard reduction potential of
right-hand electrode (cathode) minus the standard reduction potential of the
left-hand electrode (anode). That is,

$E_{ocell} = E_{oright} - E_{o\ left}$

= Cathode potential – Anode potential

31. When equal amounts of d-isomer and l-isomer are mixed one gets a
''racemic mixture'' and this process is called racemisation. A racemic mixture
becomes optically inactive. Because, in this mixture rotation towards
clockwise direction by the dextro isomers is compensated by the rotation
towards the anticlockwise direction by the laevo isomers.Eg:d,l lactic acid

32.



* C = asymmetric carbon atom

fructose

(1, 3, 4, 5, 6, pentahydroxy-2-hexanone)

Fructose molecules have 4 chiral centers of their carbon atoms. A maximum of 2^n optical isomers can occur for a molecule, where 'n' is the number of chiral centers. Since there are 4 chiral centers in fructose, it should have 2^4 = **16 optical isomers**.

33.

$\log k_1/k_2 = E_a/2.303\ R[1/T_2 - 1/T_1]$

$\therefore k_1/k_2 = 100000 J\ Mole^{-1}/2.303 * 8\ 314 JK^{-1} mol^{-1}$

$= -0.5745$

$\therefore k_1/k_2$ antilog (–0.5745)

= 0.2664

$k_2 = 1/0.2664 k_1$ = 3.75 times k_1.

$\therefore k_2$, the rate constant at 35°C will be 3.75 times the rate constant at 25°C.

34.a) i) a) CO_2-sp b)NO_2- sp^2

c)ClO_2^- -sp^3 d)XeF_2 –sp^3d

ii) **"it is impossible to measure simultaneously both the position and velocity (or momentum) of a microscopic particle with absolute accuracy or certainty."**

Mathematically, uncertainty principle can be put as follows. $$\Delta x . \Delta p \geq \frac{h}{4\pi}$$

where, Δx = uncertainity in the position of the particle and Δp = uncertainity in the momentum of the particle.

Or

b)i) One of the familiar characteristic of p-block elements is to show inert pair effect i.e. the tendency of being less availability for ns electron in bonding.

The inert pair effect increases down the group with the increase in atomic number.

ii) 1) Silicones act as excellent insulators for electric motors and other appliances as they can withstand high temperatures.

2) Straight chain polymers of 20 to 500 units are used as silicone fluids. They are water repellent because of the organic side group. These polymers are used in waterproofing textiles, as lubricants and as polish.

3) Silicone rubber retain their elasticity even at low temperatures and resist chemical attack. They are mixed with paints to make them damp-resistant.

35.a)i)$[Ti(H_2O)_6]^{3+}$ is coloured because Ti^{3+} one electron present in d orbital The colour of transition metal ions is due to the presence of unpaired electrons in it and the energy gap between two energy levels in the same d-subshell being small. Sc^{3+} ions are also colourless because of the absence of d-electrons.

ii) The articles to be plated with chromium are made the cathode in an electrolytic bath consisting of chromic acid and sulphuric acid while the anode is made of a plate of lead. During electrolysis chromium deposits on the article (cathode). Generally the articles are first plated with nickel and then subjected to chromium plating.

Or

b)i)

1) Every metal atom has two types of valencies

i) Primary valency or ionisable valency

ii) Secondary valency or non ionisable valency

2) The primary valency corresponds to the oxidation state of the metal ion.

The primary valency of the metal ion is always satisfied by negative ions. 3) Secondary valency corresponds to the coordination number of the metal ion or atom. The secondary valencies may be satisfied by either negative ions or neutral molecules.

4) The molecules or ion that satisfy secondary valencies are called ligands.

5) The ligands which satisfy secondary valencies must project in definite directions in space. So the secondary valencies are directional in nature whereas the primary valencies are non-directional in nature.

6) The ligands have unshared pair of electrons. These unshared pair of electrons are donated to central metal ion or atom in a compound. Such compounds are called coordination compounds.

36.a)i) The lattice points in molecular crystals consist of molecules which do not carry any charge. The forces binding the molecules together are of two types (i) Dipole-dipole interaction and (ii) Vanderwaal's forces. Dipole-dipole forces occur in solids which consists of polar molecules e.g., ice. The Vanderwaal's forces are more general and occur in all kinds of molecular solids.

ii) 1. The heats of vapourisation of ionic crystals are high.

2. The vapour pressure of ionic crystals at ordinary temperature are very low.

3. The melting and boiling points of ionic crystals are very high.

4. Ionic crystals are hard and brittle.

5. Ionic crystals are insulators in the solid state.

6. Ionic crystals are soluble in water and also in other polar solvents.

Or

b) Consider a general chemical equilibrium reaction in which the reactants and products are in gaseous phases,

$aA + bB + cC + ... \rightleftharpoons lL + mM + nN + ...$

them $K_P = P_L^{l} p_M^{m} p_N^{n....} / p_A^{a} p_B^{b} p_C^{c...}$

where p is the partial pressure of the respectivée gases. In terms of molar concentrations of reactants and products

$K_c = [L]^l [M]^m [N]^{n\cdots} / [A]^a [B]^b [C]^{c\cdots}$

For any gaseous component 'i' in a mixture, its partial pressure 'p_i' is related to its molar concentration 'C_i' as

$C_i = p_i/RT$, since $p_i = n_i/V \quad RT$

Where $n_i/V = C_i$ = number of moles of i per litre.

V = volume in litres.

Substituting, concentration terms by partial pressures,

$$K_c = \frac{(p_L/RT)^l (p_M/RT)^m (p_N/RT)^n \ldots}{(p_A/RT)^a (p_B/RT)^b (p_C/RT)^c \ldots}$$

$$= \frac{p_L^l p_M^m p_N^n \ldots\ldots}{p_A^a p_B^b p_C^e \ldots\ldots} \left(\frac{1}{RT} \right)^{(l+m+n+....)-(a+b+c+...)}$$

$$= \frac{K_p}{(RT)^{\Delta ng}} \text{ and } \quad \therefore K_p = K_c (RT)^{\Delta n_g}$$

where Δn_g = total number of stoichiometric moles of gaseous products - total number of stoichiometric moles of gaseous reactants.

37.a)i)

	Dispersion Phase	Medium
a) Paint	Solid	Liquid
b) Froths of air	Gas	Liquid

ii) A substance which destroys the activity of the catalyst is called a poison and the process is called catalytic poisoning. Some of the examples are

(i) The platinum catalyst used in the oxidation of SO_2 in contact process is poisoned by arsenious oxide.

$$SO_2 + O_2 \underset{\text{Poisoned by } As_2O_3}{\overset{Pt}{\rightleftharpoons}} 2\,SO_3$$

Or

b)i) A buffer solution is one which maintains its pH fairly constant even
upon the addition of small amounts of acid or base. In other words, a buffer solution resists (or buffers) a change in its pH.

That is, we can add a small amount of an acid or base to a buffer solution
and the pH will change very little.

ii) $K_a = 1.8 \times 10^{-5}$

$pK_a = -\log(1.8 \times 10^{-5}) = 4.7447$

$pH = pK_a + \log[\text{salt}]/[\text{acid}]$

... Henderson - Hasselbalch equation

$= 4.7447 + \log 0.5/0.5.$

$pH = 4.7447 + \log 1$

$= 4.7447$

38.a)i) The removal of water from the protonated species is facilitated by
anhydrous zinc chloride. Reactivitiy in this reaction with respect to alcohols
is $3^o > 2^o > 1^o$. This reaction is used in Lucas Test.

$$\underset{3^\circ \text{ alcohol}}{(CH_3)_3COH} \xrightarrow[\text{anhyd. } ZnCl_2]{\text{con.HCl}} (CH_3)_3C{-}Cl + H_2O$$

(Turbidity appears immediately) at room temperature

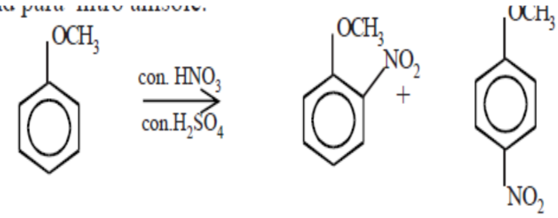
$$\underset{2^\circ \text{ alcohol}}{(CH_3)_2CHOH} \xrightarrow[\text{anhyd. } ZnCl_2]{\text{con.HCl}} (CH_3)_2CHCl + H_2O$$

(Turbidity appears after 5-10 minutes) at room temperature

$$\underset{1^\circ \text{ alcohol}}{CH_3CH_2OH} \xrightarrow[\text{anhydrous } ZnCl_2]{\text{Conc. HCl}} CH_3CH_2Cl + H_2O$$

(No turbidity appears easily) but only on heating

ii) –OH group, –OMe, group increase the reactivity of thebenzene ring with respect to electrophilic attack and is **ortho, para - directing.** With a mixture of con.HNO_3 and con. H_2SO_4 it gives a mixture of ortho and para nitro anisole.



b)i) **Reducing property**

Formic acid is unique because it contains both an aldehyde group and
carboxyl group also. Hence it **can act as a reducing** agent. It reduces
Fehling's solution, Tollens reagent and decolourises pink coloured $KMnO_4$
solution.

(a) Formic acid reduces ammoniacal silver nitrate solution (Tollen's reagent)
to metallic silver.

$HCOOH + Ag_2O \rightarrow H_2O + CO_2 + 2Ag\downarrow$

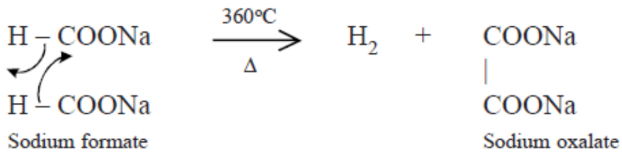
(metallic silver)

(b) Formic acid reduces Fehling's solution. It reduces blue coloured cupric
ions to red coloured cuprous ions.

$HCOO^- + 2Cu^{2+} + 5OH^- \rightarrow CO_3^{2-} + Cu_2O + 3H_2O$

(blue) (red)

(c) On the otherhand when sodium formate is heated to 360°C it decomposes
to hydrogen and sodium oxalate.



ii) Aniline reacts with chloroform and alcoholic KOH to give an offensive
smelling liquid, phenyl isocyanide.

$C_6H_5NH_2 + CHCl_3 + 3KOH \rightarrow C_6H_5NC + 3KCl + 3H_2O$

(phenyl isocyanide)