63656

Questions should be —
WRITTEN IN LEGIBLE HANDWRITING IN BLACK INK.
SIGNS, SKETCHES OR FIGURES IF ANY BE DRAWN IN NEAT BLACK INK,
so as to avoid mistakes in the printed question papers.

Duration ..... Hours. Total Marks assigned to the paper .....

ATKT paper I

N.B. : Answers set I

Q. No.		Marks
Q1		
A)		
i)	c) Heat	
ii)	c) mass	
iii)	c) 1 M	
iv)	c) H	
v)	a) closed	
vi)	b) 0.2 M	
vii)	~~c) m~~ b (L)	
viii)	b) negative	
ix)	b) 4D	
x)	b) two	
xi	c) Shielding Const.	
xii	a) ~~Metals~~	
xiii	a) sp^3	
xiv	b) electron deficient	
xv	a) –CN	
xvi	b) secondary	
xvii	b) Carbanion	
xviii	b) lewis bases	

Q1 | Q. No. | | Marks

B) i) False

ii) True

iii) True

iv) True

v) True

vi) False.

C)

i) f) $u + pv$

ii) d) 1 PPM

iii) a) Hydrogenic atom

iv) C_5

v) ~~Amide~~ g) $R-\overset{O}{\overset{\|}{C}}-NH_2$

vi) ~~Electrophile~~ b) BF_3

a)

b)

c) c^{+5}

d)

e)

f)

g) 55

h)

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Q. No.		Marks
Q2	**N.B. :**	
A)	Kirchhoff's Equation	
	$aA + bB \longrightarrow cC + dD$	
	$\Delta H_{reaction} = \sum H_{products} - \sum H_{reactants}$	(1M)
	$\Delta H = (cH_C + dH_D) - (aH_A + bH_B)$	
	$\therefore \left[\frac{d(\Delta H)}{dT}\right]_P = \left[c\left(\frac{dH_C}{dT}\right)_P + d\left(\frac{dH_D}{dT}\right)_P\right] - \left[a\left(\frac{dH_A}{dT}\right)_P + b\left(\frac{dH_B}{dT}\right)_P\right]$	(1M)
	$\because C_P = \left(\frac{dH}{dT}\right)_P$	
	$\therefore \left[\frac{d(\Delta H)}{dT}\right]_P = \sum C_P(\text{products}) - \sum C_P(\text{reactants})$	(1M)
	$= \Delta C_P$	
	$\therefore d(\Delta H) = \Delta C_P \, dT$	
	Integrating $\Delta H_2 = \Delta H_1 + \Delta C_P (T_2 - T_1)$	(1M)
	similarly at constant volume	
	$\Delta E_2 = \Delta E_1 + \Delta C_V (T_2 - T_1)$	(1M)

Q. No. | Marks

Q2

A) Definition with equation (2M)

$M_1V_1 = M_2V_2$ (1M)

$5 \times V_1 = 0.837 \times 100$ (1M)

$V_1 = 16.74\ cm^3$ (1M)

C) i) Definition of enthalpy 1M

Equation 1/2M

characteristics (any two) 1M

ii) definition of internal energy 1M

characteristics (any three) 1/2M

D) Def^n of equivalent weight (2M)

with proper equation

$0.05 = \frac{w}{98} \cdot \frac{1000}{250}$ (2M)

$w = 1.225\ g$ (1M)

E) $\Delta H = \Delta E + \Delta n RT$ (1M)

$\Delta n = (1+1) - 1 = 1\ mole$ 1M

$-\Delta H = -57.5 + (1)(8.314 \times 10^{-3}) \times 298$

$= -57.5 + 2.477$ (2M)

$\Delta H = -55.022\ kJ\ mol^{-1}$ (1M)

F) Any two forms of first law (2M)

$\Delta E = q + w$ (Derivation) (2M)

Conventions of terms involved (1M)

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Duration ..... Hours. Total Marks assigned to the paper .....

Q. No.	N.B. :	Marks

Q.3. A) Postulates of Bohr's Atomic Model [10 5]

1) Electrons in an atom are revolving around the nucleus in fixed circular orbital. stationary orbitals. 01

2) certain energy levels, They do not radiate energy. 01

3) Angular momentum of electron in stationary state is integral multiple of $\frac{h}{2\pi}$ i.e. $mvr = n\frac{h}{2\pi}$ m is mass, v is velocity of electron r = distance. h = Planks const. n is principle no. 01

4) $\Delta E = E_2 - E_1 = h\nu$. when an electron moves from one orbit to another, it emits or absorb energy in fixed amount. 01

5) The value of ΔE is fixed if n = 1 energy E_1 and absorbs energy photons to n = 2 energy will be E_2 absorb energy $\Delta E = E_1 - E_2$. 01

Q. No. | Marks

Q.3 B) Drawback of Rutherford's Atomic Model.

1) It does not explained behaviour of electron. 01

2) planet concept could not explain Stability of atom because nucleus and electrons are charged bodies such arrangement cannot remain stable. 01

According electromagnetic theory rotating electrons radiate energy. short explaination. — 02 marks.

It also failed to explained empirical data which is used in atomic spectra. 01 marks.

Q. No.

Marks

9-3. c) Zeff of Oxygen.

Z = 8

electronic configuration — 0 1 m.

$1s^2\ 2s^2\ 2p^4$

$(1s^2)$ $(2s^2\ 2p^4)$ — 1 m

5×0.35

2×0.85 for inner electrn.

$Z - S$.

Zeff =

$S = (2 \times 0.85) + (5 \times 0.35) = 3.45$

$Z_{eff} = 8 - 3.45$

$= 4.55$

Q3 D) • S & P blocks elements — Main group 63656 (8)
• electrons are filled in s & p — incompletely filled 1M
Together s & p — main group elements
Q3
• eg. 1 & 2 — S block, — 1 e^- & 2 e^- in IA & IIA gr in outermost orbital 1M
• Reactive & form ionic compounds Metals. 1M
• P block eg. 13 to 18 — non metals 1M
representative eg. 1, 2, 13 to 17
& 18 gr. inert gases 1M.

E) Mulliken calculation of electronegativity — basis of
• ionisation energy & electron affinity 1M
• Electronegativity = $I + E/2$ 1M
• I & E — $KJ\,mol^{-1}$ — called from. oxidation state of 1M
Same elements.
• Mullikens electronegativity 2.8 times > Pauling 1M
• $X_B^m - X_A^m = 2.78(X_B^P - X_A^P)$ 1M

f) Magnitude of enthalpy of ionisation
• size of atom — At. size ↑, enthalpy of ionsation decreases 1M
• greater the charge — greater enthalpy of ionisation 1M
• s > p > d > f enthalpy of ionisation decreases in this order 1M
• effective nuclear charge decreases, I E decreases 1M
• Enthalpy of ionisation is high — ~~high~~ half filled + completely filled 1M.

Q5 D) Slater rules

⟶ 1m each.

Q.4 A] 1. Cyclopentanecarbonitrile

2. 2-chloropropanamine.

3. 2-Nitro-2-butene

4. 2,3-dichloropentanoic acid.

5. Pent-3-ene-2-one ——— 1 m each.

B] Sp-hybridization of carbon :

example — 1 m

Structure - orbital picture - 1 m.

Explanation - 2 m.

orbital picture of ethene = 1 m.

C] Stability of Carbanion :

Inductive effect :- Example with ~~canonical~~ tertiary carb., sec. carb., primary strucures. $1\frac{1}{2}$ m

Explanation - 1 m.

Resonance effect :- Resonance structures allyl anion / benzyl anion. $1\frac{1}{2}$ m.

Explanation : ~~2 m~~ - 1 m.

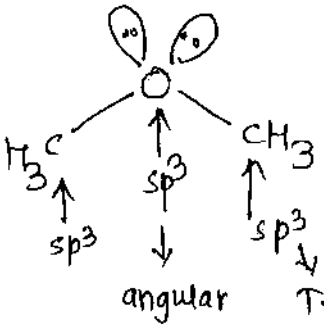
D] Structure and shape of dimethyl ether :-

Structure : 1 - m.

Shape : 1 - m.

Hybridisation : 1 - m

Explanation : 2 - m.



Q. No.		Marks
Q5		
A)	i) Definition of ppm	1M
	Expression	1½M
	ii) Definition of ppb	(1M)
	Expression	(1½M)
B)	$W = -P(V_2 - V_1)$	(1M)
	$V_1 = \frac{nRT}{P} = \frac{4 \times 8.314 \times 301}{4 \times 1.013 \times 10^5}$	(1M)
	$= 49.354\ dm^3 = 0.0493\ m^3$	
	$V_2 = 49.354 \times \frac{1}{3} = 16.45\ dm^3 = 0.0164\ m^3$	(1M)
	$W = -P(V_2 - V_1)$	
	$= -4 \times 1.013 \times 10^5 (16.45 - 49.354) \times 10^{-3}$	
	$= 131.65\ atm\ dm^3$	
	$= 133.35 \times 10^2\ J$	(2M)

Q.5

c) Write a note on Aufbau principle.

electron enter the orbitals in the order of increasing energies. The lowest energy available orbitals being filled up first.

(1) Orbitals are filled in order of increasing value of $n+l$.

eg. 4s ($n=4, l=0$ (s))

$n+l$, $4+0=4$ is filled before 3d.

for the orbitals having same value of $n+l$ the orbital having lower value of n.

1s, < 2s, < 2p < 3s < 3p < 4s

Aufbau order of filling of electrons.

Q5 D) • Slater rules – 's'- shielding const 1 M

$S=0$, each e^- in group

• $S=0.35$ each e^- in group (n) except 1s(0.30) 1 M

• $S=0.85$ for n-1 group 1 M

• $S=1.00$ for e^- closer to (n-1) group 1 M

• $S=1.00$ for e^- lower groups if d & f electron under consideration.

1 M.

Q.5 e] Free radicals – Def^{n} – 1 M.

Hyperconjugation structures for t-free radical, sec-free radical and primary free radicals. – 3 M.

Explanation. – 1 - M.

F] sp - hybridization of nitrogen. :- example - – 1 M.

structure and explanation – 03 M.

Orbital picture of methylamine. – 1 M.