$$\text{if} = \frac{v}{2\pi R} = \frac{v_0 \frac{Z}{n}}{2\pi v_0 \times \frac{n^2}{z}}$$

$$\text{force} \propto \frac{z^3}{n^4} \; ; f \propto \frac{z^2}{n^3}$$

19. An ideal gas is allowed to expand form 1 L to 10 L against a constant external pressure of 1 bar. The work done in kJ is:

(1) +10.0 (2) −0.9 (3) −2.0 (4) −9.0

Ans. (2)

Sol. w = −(9) × 0.1 = − 0.9 kJ

20. The number of radial and angular nodes in 4d-orbital are respectively

(1) 1 and 2 (2) 3 and 2 (3) 1 and 0 (4) 2 and 1

Ans. (1)

Sol. 4d

(n − l − 1) = radial node

4 − 2 − 1 = 1

l = 2

21. Some amount of urea is added to 1000 gm of H_2O due to which the vapour pressure decreases by 25% of the original vapour pressure. Find out the mass of urea added (Round off 2 decimal places)

Ans. **1111.11**

Sol. $\frac{P^o - P}{P^o} = X_{solute}$

$\frac{P^o - P}{P^o} = \frac{n}{n+N}$ (n = mole of solute, N = mole of solvent)

$$\frac{100-75}{100} = \frac{\frac{W}{60}}{\frac{W}{60} + \frac{1000}{18}}$$

$$\frac{1}{4} = \frac{W}{60\left(\frac{W}{60} + \frac{1000}{18}\right)}$$

$$W + \frac{1000 \times 60}{18} = 4W$$

$$\frac{1000 \times 60}{18} = 3W$$

W = 1111.11 gm

22. Match column-I (Compound) with column-II final product obtained during their qualitative analysis)

Column-I		Column-II	
(A)	Nitrogen	(P)	AgX
(B)	Sulphur	(Q)	$(NH_4)_3PO_4.12\ MoO_3$
(C)	Phosphorous	(R)	$Fe(SCN)_3$
(D)	Halogens	(S)	$Fe_4[Fe(CN)_6]_3$

(1) A → P; B → R; C → Q, D → S (2) A → R; B → P; C → Q, D → S

(3) A → S; B → R; C → Q, D → P (4) A → Q; B → R; C → P, D → S

Ans. **(3)**

23. Find log k, if $\Delta H^\circ = -54.07$ kJ/mol & T = 298 K, ΔS° = 10 J/mol K.

Also given 2.303 × 298 = 5705.

Ans. **1.2**

Sol. $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ .....(1)

$\Delta G^\circ = -RT \ln k$

$\Delta G^\circ = -2.303\ RT \log K$.....(2)

From eq. (1) & (2)

$-2.303\ RT \log K = \Delta H^\circ - T\Delta S^\circ$

$$-2.303 \times 8.314 \times 298 \log K = \frac{-54.07 - 2.98 \times 10}{1000}$$

Log K = 1.2

24. Oxidation state of Mo in Ammonium Phosphomolybdate is:

Ans. **6**

Sol. $(NH_4)_3PO_4.12MoO_3$

3(+1) + (−3) + 12x + 36 (−2) = 0

x = +6