Roll No. _____

S-624

B.Sc. (Part-II) Examination, 2015

CHEMISTRY

Third Paper

(Physical)

Time Allowed : Three Hours]   *[Maximum Marks : 50*

Note : (i) Answer five questions in all.

केânue heeÙe ØeMeeWkeâ Gòej oerpeS~

(ii) Question No. 1 is compulsory.

ØeMve meb 1 DeefveJeeÙe&nw~

(iii) Attempt one question from each unit.

ØelÙeskeâ FkeâeF&mes Skeâ ØeMve keâerefpeS~

(iv) Log tables will be supplied on request.

cebÙeves hej ueesâie meejCeer oer peSieer~

1. Answer the following : 2×10

   efvecveefueefKele keââ Gòej oerpeS :

   (a) Why hydrogen and helium get warmed up on adiabatic expansion through Porus plug while most of the gases get cooled?

   neF[^ûpeve Deûj nerefueÙece heâjme hueie mesefMeLejjce ØemeejCe celeâjver Ce keââjves hej keâÙeeWiece nes peeleer nQpeyeâefkeâ DeefOekeââlej ieme

2. (a) Show that for an isothermal process Reversible work of expansion is greater than the irreversible work of expansion.

   oMee&FS efkeâ Skeâ meceleeheerÙe Gl›eâceCeerÙe Øemeej celÙekeââjves ielee keâârCe& Deveûl›eâceCeerÙe Øemeej mes DeefOekeâ   nw 4

   (b) Six moles of an ideal gas expand isothermally and Reversibly from a volume of $1 dm^3$ to a volume of $10\ dm^3$ at 27^0C. What is the work done?   3½

   peye Skeâ DeeoMe& iesme keâ 6 ceesue meceleeheerÙe Gl›eâceCeerÙe eJeâDe mes 27^0C hej $1 dm^3$ DeeÙeleve mes $10\ dm^3$ DeeÙeleve lekeâ Heâieuleer nw lees efkeâÙee ielee keâjÙe keââefkeâÙeeJee nP?

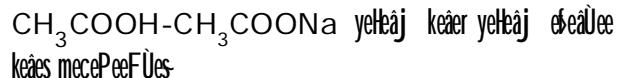$CH_3COOH - CH_3COONa$ yeHeâj keâer yeHeâj efâeâÙee keââes mecePeeFÙes~

(j) A substance has its triple point (o) at 18^0C and 0.5 atm. Its normal melting point (A) is 20^0C and its normal boiling point (B) is 300^0C. Sketch the phase diagram for the substance. What-Phases are in equilibrium along line OB.

Skeâ heoeLe& keââe ef�$ekeââ efyevog (o) 18^0C leLee 0.5 JeeÙegceC[ueëeòe oeye hej nw~ Gmekeââe meeceevÙe ieuevekeââ (A) 20^0C leLee meeceevÙe keââLeveeâ (B) 300^0C hej nw~ heoeLe& efâejkeââiele ef[Ùe$ jKeeefkeââle keââefjS~ jKee OB hej keââwe mees/eeJemLee meecÙeeJemLee ceWnQ~

Unit - I

FkeâeF& - I

"C[er nespeleer nl

(b) Under what conditions heat of reaction at constant pressure and heat of reaction at constant volume be equal?

efkeâve heefjefmLeleÙeeWceWefmLej oeye hej DeeYeesÙeefÙe T<ce efmLej DeeÙeleve hej DeeYeesÙeefÙe T<ce keâ yejeyej neleer nl?

(c) Explain the effect of temperature on the solubility of an electrolyte given that the dissolution of the electrolyte in water is an endothermic process.

efkeâmeer T<ceMeesmer peueÙe DeheleššÙe keâer efueueÙelee hej leehe keâe keÙee ØeYeeJe nelee~ Deheves Góej keââ DeemUelÙe keââsyeleeSb~

(d) Which will have greater entropy in the following cases.

efvecveefueefKele efmLeefleÙeeWceW efkeâve ceWSCššer keââ ceeve DeeOekeâ nejee?

(i) a magnetised or a non-magnetised piece of iron

ueemskeâ Skeâ Ûegpykeââle šyeâ[sÙee DeÛegpykeââle šyeâ[[cel

(ii) a mole of gas contained in a container of one liter capacity or that contained in a container of two liter capacity.

efkeââmeer ieme keâ 1 mole keâer SCššeer peye efkeâ Jen 1 ueešj keâ yeleŠe ceWnÙUee 2 ueešj keâ yeleŠe ceWnÙ

(e) What is Residual entropy?

yeÙUer SCššeer keâler nelkeer nÙ?

(f) Discuss the curve obtained in the conductometric titration of an aqueous solution of Hydrochloric acid and aqueous solution of sodium hydroxide.

neF[Ökeefueeesefj keâ Decue leLee meesš[Ùece neF[ÖkeâimeeF[keâ peueeÙe efueueÙeveeWkeâ Ûeeuekeâeleecceer Deveogeeheve keâ Je>eâ keâe efueJeŠeevee keââsp eS~

(g) What is critical solution temperature? Explain giving example.

›eââefvlekeâ efueueÙeve leehe>eâce keâelee nl? GoenjCe efle mecePeeF S~

(h) A cell is prepared by dipping a copper rod in 1M $CuSO_4$ solution and a nickel rod in 1M $NiSO_4$ solution and joining the two solutions by a salt bridge. If

1M keâhej meulHeâš keâ efueueÙeve ceWkeâhej keâer Skeâ ÚÌ[leLee 1M efvekeâue meulHeâš keâ efueueÙeve ceWefvekeâue keâer Skeâ ÚÌ[[yeekeâj leLee oesveWefueueÙeveeWkeâes ueJeCe mele Éeje peeš[keââj Skeâ mesue yeveeÙee ieÙee nŠ Ùeefo

$E^0_{cu^{++}} / Cu = + 0.34V$ and (leLee)

$E^0_{Ni^{++}} / Ni = - 0.25V$ nŠ lee:

respectively.

(i) Which electrode will be positive?

OeveeÙlekeâ Fue>âšÊeâ[keââØe mee nelee?

(ii) What will be the cell reaction?

mesue ceWmesue DeeYeesefâÙee keâlee neleer~

(i) Explain the buffer action of CH_3COOH-CH_3COONa buffer.

(b) What are Azeotropic mixtures? Why Azeotropic mixtures are constant boiling mixtures? 4

efnLej keâleeLeeieâ efceßeCe keâlee nesles nØ? efnLej keâleeLeeieâ efceßeCe efnLej keâleeLeeieâ efceßeCe keâdleeWnesles nØ?

Unit - IV
FkeâeF&- IV

8. (a) Giving a suitable example, explain what is the difference between a concentration cell and a chemical cell. 2½

GheÙegieâ GoenjCe oesles nÖ§ meeceûeeefvekeâ meeceJÕ lee mesûe leLee jemeefUeefvekeâ mesûe ceWkeâÙee efYeVelee nesleer nû

(b) Derive the expression for emf of a concentration cell with and without transference. 5

Šôšmeheeefš&&meeefn leLee efvevee Šôvmeheeefn&&Jeeues meeevõ lee mesûe mesûe keâ efee.Jee.ye. keâ JÙebhekeââlekeâ ef veieceve keâeeefepeS~

9. (a) State Phase rule and explain the terms involved in it. 4

ÖeJemLee efvelece keâe keââLeve keâeeefepeS leLea ÖeJeûieâ heoeWkeâea JÙeeKÙee keââeefepeS~

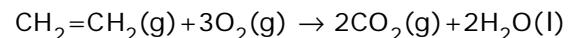(b) Discuss the phase diagram of sulphur system. 3½

meuHkeâj keâ efvekeâeÙe ÖeJemLee keâ efleeJeevee keâeeefepeS~

3. (a) Derive Kircoff's equation for variation of enthalpy of a reaction with temperature.

DeeYeefemeeefÙee keââer T<cee keââe leeehe>eâceevemeceej heefj Jeleefie oMeefiee: Jeeues efkeââer Ùeeefieâ mecceekeââjCe keâer JÙeiejheefoâe keââeeefepeS~ 4

(b) Calculate ΔH for the reaction

$$CH_2=CH_2(g)+3O_2(g) \rightarrow 2CO_2(g)+2H_2O(l)$$

given the following bond energies.

Bond	C-H	O=O	C=O	O-H	C=C
Bond Energy (KJ/mole)	416.2	493.7	711.3	464.4	615.0
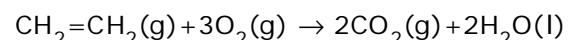
DeeYeefemeeeÙee

$$CH_2=CH_2(g)+3O_2(g) \rightarrow 2CO_2(g)+2H_2O(l)$$

ceWDeeYeefemeeeÙee T<cee (ΔH) keââer ieCevee keâeeefepeS~

Ùeefo

yevOe	C-H	O=O	C=O	O-H	C=C
yevOe Tpeeâ (KJ/mole)	416.2	493.7	711.3	464.4	615.0

3½

Unit - II
FkeâeF&- II

4. (a) Prove that the total entropy of a system and its surroundings increases during an irreversible process. 4

meeefÙeeefefnle keâeeefepeS efkeââ ekeââeâmeer efvekeââeÙee leLee heefjmejj keââer kegue SCšÖeheer meceeleeheeeÙee DeefÖ>eâceCee Öemeej ceWyek{leer nû

(b) Calculate the entropy change when 2 moles of an ideal gas are allowed to expand reversibly at 298 K from a pressure of 10 atmosphere to a pressure of 2 atmosphere. 3½

SCšÖheer heâj Jelešŝe keâer ieCevee keâeefpeS peye ešŝkeâ Skeâ DeeoMe& iewme keâ 2 ceesue keâe Gl›eâceCeešŝle Ìemeej 298 K hej 10 JeeÙeegegC[ue oeye mes 2 JeeÙeegC[ue oeye lekeâ neÛee nw

5. (a) Derive the relation 4

JÙeglheoeefle keâeefpeS:

$$\Delta G = \Delta H + T\left[\frac{\partial(\Delta G)}{\partial T}\right]_P$$

(b) Derive an expression to prove that multistep extraction is more effective than a single step extraction. 3½

keâF&heoeWleeWefve&keâ-eCe keâer efleeÖe Skeâ heo efve&keâ-eCe mes DeeÖekeâe GheÙeesieer nw, Fme nleÖglÙele pekeâer keâer JÙeglheoeefle keâeefpeS~

<center>Unit - I I I</center>

<center>FkeâeF&- I I I</center>

6. (a) What do you understand by specific and equivalent conductance of an electrolyte? How are they related? Why specific conductance decreases whereas equivalent conductance increases with dilution? 4

efleeMe° Ûeeuekeâlee leLee legÙÙeeheÛeeâer Ûeeuekeâlee Deehe keâlee mecePeles nP FvecelWkeÙlee mecyevOe nP leveJee yeÙ{eves hej efleeMe° Ûeeuekeâlee keefleeMleÙeernwp eyeÙeekeâ legÙÙeeÙeÙeÙeheÙeekeâer Ûeeuekeâlee yeÙ{leer nP

(b) Specific conductance of a 0.12N solution of an electrolyte is 0.024 $ohm^{-1}cm^{-1}$. Find out its equivalent conductance. 3½

Skeâ DeheleešŝŝJŝe keâ 0.12N eefleeuÙeÙe keâer efleeMe° Ûeeuekeâlee 0.024 $ohm^{-1}cm^{-1}$ nw Gmekeâer legÙÙeeheÙeekeâer Ûeeuekeâlee efvekeâeecÙeeS~

7. (a) How is transport number of an ion related to its ionic conductance? The transport number of Ag^+ ion in $AgNO_3$ solution is 0.48. The equivalent conductance of $AgNO_3$ at infinite dilution is 120 $ohm^{-1} cm^{-2}equi^{-1}$, calculate the ionic conductance of NO_3^{-1} ion. 3½

Skeâ DeeÙŝeve keâ DeeÙŝieceveeŝŝ leLee DeeÙŝeefvekeâ Ûeeuekeâlee cel keŝŝlee mecyevOe nP?

Ag^+ ion keâe efveuJej veeFšÒ keâ efleeueÙŝŝe celDeeÙŝieceveeŝŝ 0.48 nw efveuJej veeFšÒ keâer Devevle leveÙee hej legÙŝeâ Ûeeuekeâlee 120 $ohm^{-1} cm^{-2}equi^{-1}$ nw efveuÙŝŝe celNO_3^- DeeÙŝeve keâer DeeÙŝeefvekeâ Ûeeuekeâlee efvekeâeecÙŝeS~