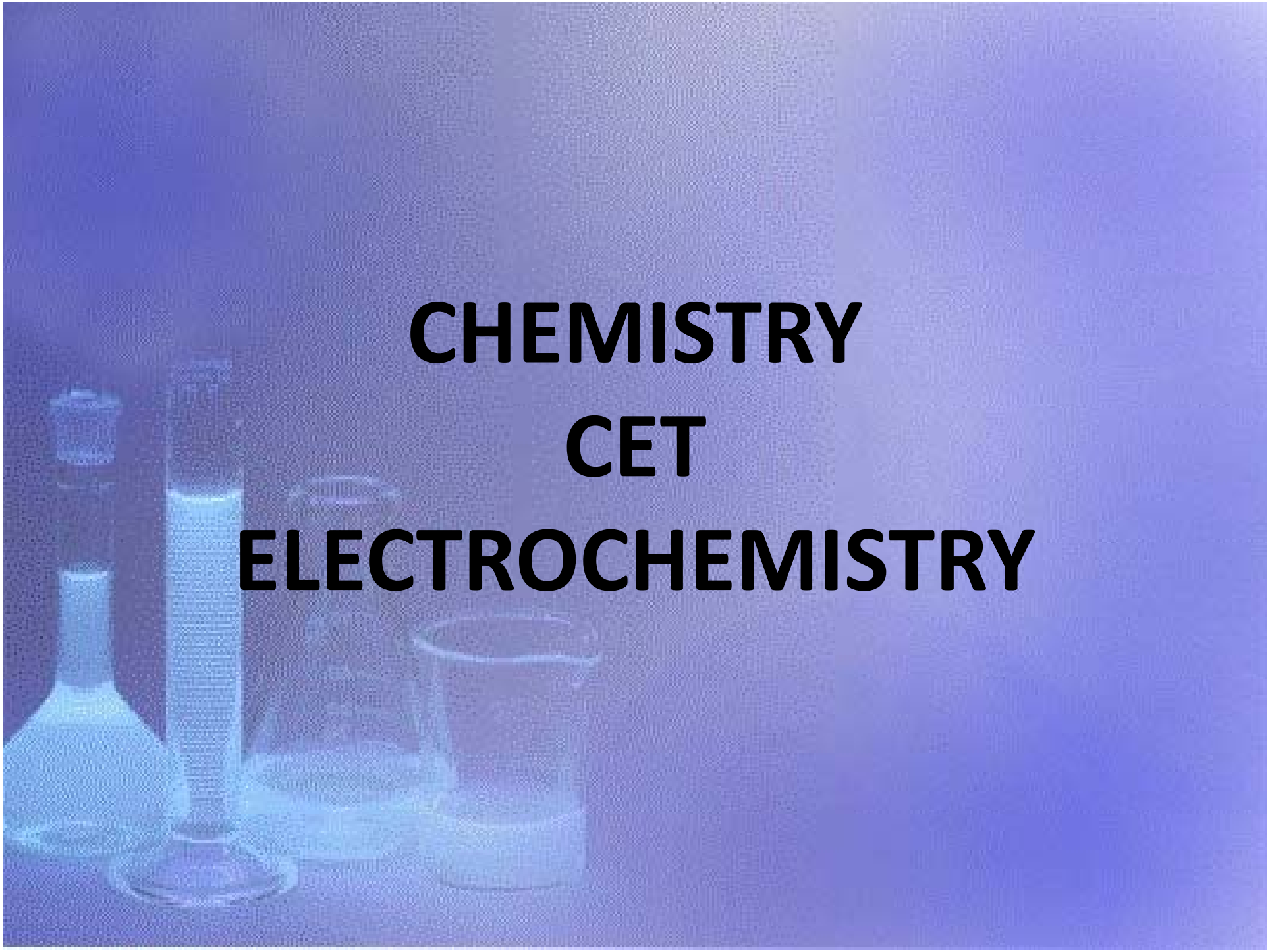
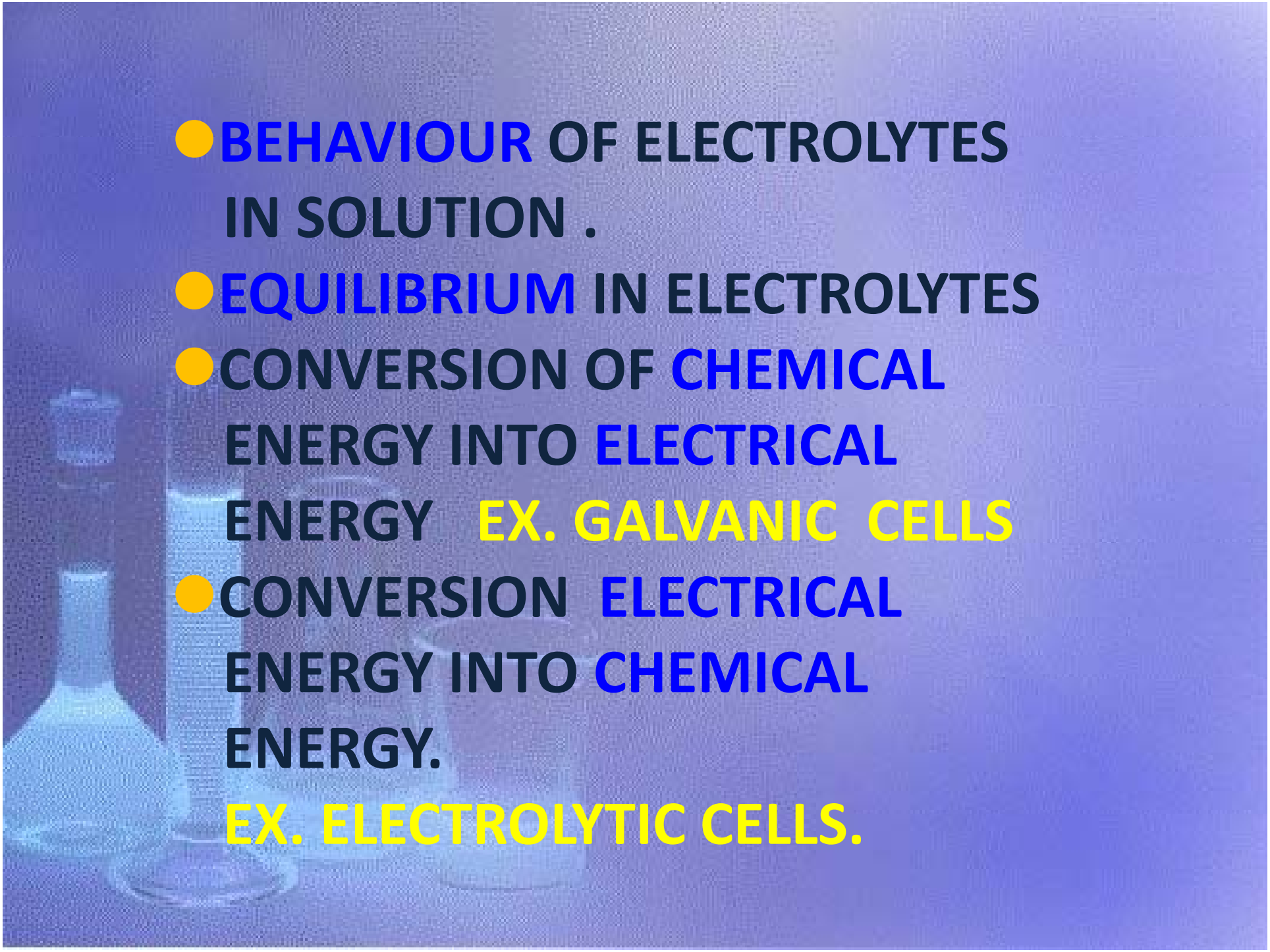

CHEMISTRY
CET
ELECTROCHEMISTRY

LET US BRIEFLY DISCUSS WHAT WE STUDIED IN ELECTROCHEMISTRY CHAPTER BEFORE WE LOOK INTO C.E.T QUESTIONS.

WHAT IS ELECTROCHEMISTRY?

IT IS A BRANCH OF CHEMISTRY WHICH DEALS WITH THE STUDY OF;


BEHAVIOUR OF ELECTROLYTES IN SOLUTION .
EQUILIBRIUM IN ELECTROLYTES
CONVERSION OF CHEMICAL ENERGY INTO ELECTRICAL ENERGY EX. GALVANIC CELLS
CONVERSION ELECTRICAL ENERGY INTO CHEMICAL ENERGY.
EX. ELECTROLYTIC CELLS.

LET US UNDERSTAND SOME IMPORTANT TERMS USED IN ELECTROCHEMISTRY AND THEIR MEANINGS.

CONDUCTORS:

THESE ARE THE SUBSTANCES WHICH ALLOW ELECTRICITY TO PASS THROUGH THEM.

EX. METALS, SALT SOLUTIONS, GASES UNDER LOW PRESSURE

INSULATORS: SUBSTANCES WHICH DO NOT ALLOW ELECTRICITY TO PASS THROUGH THEM.

EX. PAPER, GLASS, WOOD, BENZENE.

ELECTROLYTIC CONDUCTORS:

THESE ARE ELECTROLYTES WHICH ALLOW ELECTRICITY TO PASS THROUGH THEM EITHER IN MOLTEN STATE OR DISSOLVED STATE.

ELECTROLYTES: THESE ARE FURTHER CLASSIFIED INTO

1.STRONG ELECTROLYES

2.WEAK ELECTROLYTES

STRONG ELECTROLYTES UNDERGO **COMPLETE** IONISATION IN AQUEOUS SOLUTIONS.

EX. ALL STRONG ACIDS ,BASES AND THEIR SALTS. SALT OF WEAK ACID WITH STRONG BASE ,

....

… AND SALT OF STRONG ACID WITH WEAKBASE.

WEAK ELECTROLYTES UNDERGO PARTIAL IONISATION IN AQUEOUS SOLUTION.

EX. ALL WEAK ACIDS, BASES AND THEIR SALTS.

COULOMB(C):IT INDICATES THE UNIT OF QUANTITY OF ELECTRICITY. WHEN 1 AMPERE CURRENT FLOWS FOR 1 SECOND THEN THE THE NUMBER OF COULOMBS TRANSFERRED IS EQUAL TO 1COULMB

$$Q = I \times t$$

FARADAY (F): 1F= 96500 C

WHEN 1F OF ELECTRICITY IS PASSED THROUGH A SOLUTION OF A ELECTROLYTE , 1GRAM EQUIVALENT WEIGHT OF ELECTROLYTE IS DISSOLVED OR DEPOSITED.

1F OF ELECTRICITY CONTAINS 6.022×10^{23} ELECTRONS.

FARADAY'S ILAW OF ELECTROLYSIS

IT STATES THAT 'MASS OF SUBSTANCE DEPOSITED AT THE ELECTRODE IS DIRECTLY PROPORTIONAL TO THE QUANTITY OF ELECTRICITY PASSED THROUGH THE SOLUTION.'

$$W \propto Q$$

$$W = ZQ = ZIt$$

$$W = \frac{EIt}{96500}$$

FARADAYS II LAW:

WHEN SAME QUANTITY OF ELECTRICITY PASSED THROUGH SOLUTIONS OF DIFFERENT ELECTROLYTES CONNECTED IN SERIES THE AMOUNT OF SUBSTANCES LIBERATED AT THE ELECTRODES IS DIRECTLY

PROPORTIONAL TO THEIR Eq.wt.

EX. IF DIFFERENT ELCTROLYTES CONNECTED IN SERIES, THEN

$$\frac{Wcu}{Eq.Wt.of\ cu} = \frac{WAg}{Eq.Wt.\ Ag} =$$

$$\frac{V\ OF\ H2\ AT\ STP}{11200} = \frac{V\ OF\ O2\ AT\ STP}{5600}$$

SPECIFIC CONDUCTANCE ;

IT IS THE CONDUCTANCE PRODUCED ALL THE IONS BETWEEN THE TWO ELECTRODES OF 1m3 SOLUTION.

$$R \propto \frac{l}{a} \qquad R = \sigma \frac{l}{a} \qquad \frac{1}{R} = \frac{1}{\sigma} \frac{a}{l}$$

$$C = K \frac{l}{a} \qquad K = C \frac{a}{l}$$

UNIT(SIEMEN.m^{-1})

EQUIVALENT CONDUCTIVITY.

IT IS DEFINED AS THE CONDUCTIVITY PRODUCED ALL THE IONS PRESENT ONE 1g Eq.wt OF ELECTROLYTE.

$$\Lambda = K.V/1000$$

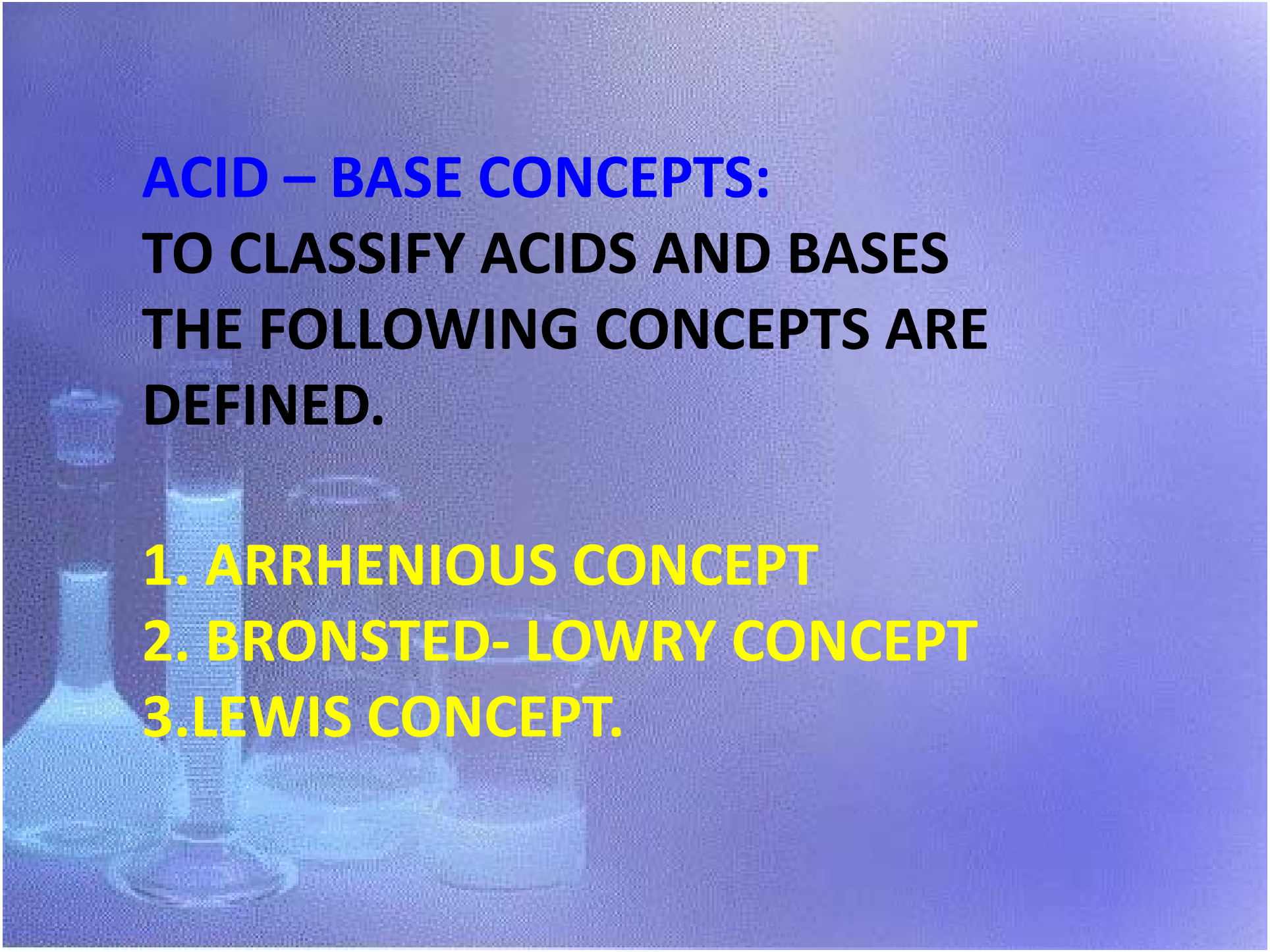
$$= \frac{K \times V}{1000}$$

SIEMEN.m^2.$eq.^{-1}$

MOLAR CONDUCTIVITY (μ)

IT IS DEFINED AS THE CONDUCTIVITY PRODUCED BY ALL THE IONS PRESENT IN ONE MOLE OF THE ELECTROLYTE AT THE GIVEN CONCENTRATION.

$$\mu = \frac{KxV}{1000} \quad \text{SIEMEN.m}^2\text{.mol.}^{-1}$$



ACID – BASE CONCEPTS:

TO CLASSIFY ACIDS AND BASES THE FOLLOWING CONCEPTS ARE DEFINED.

1. ARRHENIOUS CONCEPT
2. BRONSTED- LOWRY CONCEPT
3. LEWIS CONCEPT.

ARRHENEOUS CONCEPT:

BASED ON THIS

ACID IS A SUBSTANCE WHICH DISSOCIATES TO H^+ IONS IN WATER.

BASE IS A SUBSTANCE WHICH DISSOCIATES TO GIVE OH^- IONS IN WATER.

BRONSTED-LOWRY CONCEPT:

ACCORDING THIS CONCEPT ACID IS A SUBSTANCE WHICH DONATES A PROTON, AND BASE IS A SUBSTANCE WHICH ACEPTS A PROTON.

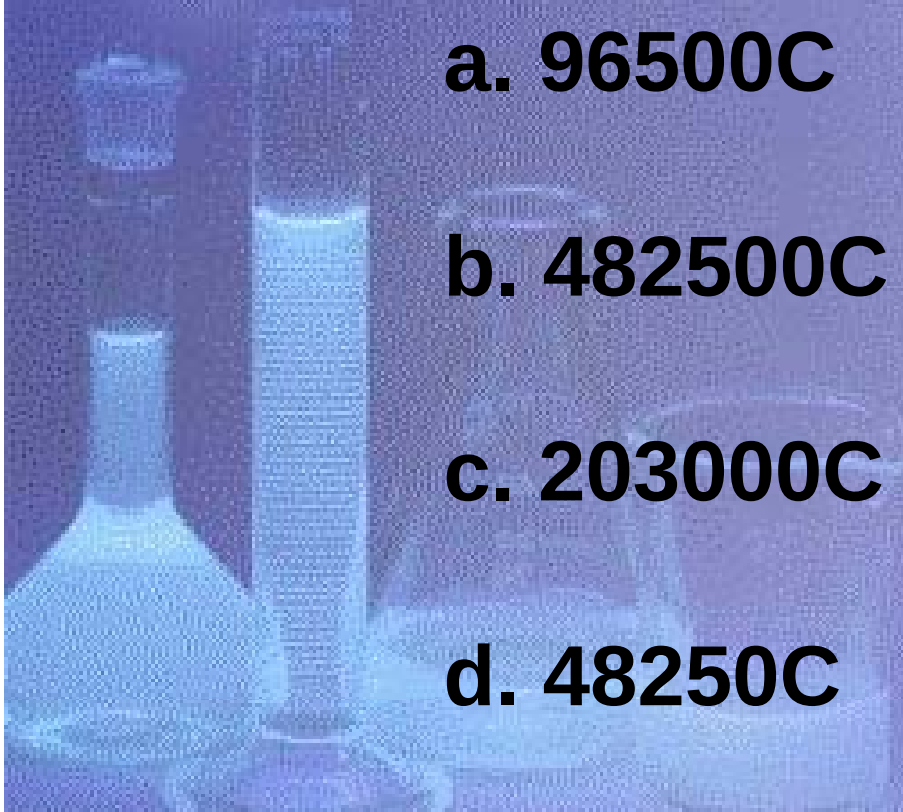
CONJUGATE ACID-BASE PAIR:

A PAIR OF AN ACID AND BASE DIFFERS BY A PROTON IS CALLED CONJUGATE ACID- BASE PAIR.

FACTORS WHICH INFLUENCE THE CONDUCTANCE OF A SOLUTION

1, NATURE OF ELECTROLYTE
2. NATURE OF SOLVENT
3. CONCENTRATION
4. TEMPERATURE
5. PRESENCE OF OTHER IONS

Q.1 THE NUMBER OF COULMBS ARE REQUIRED FOR THE REDUCTION OF IMOLE OF $MnO4^{-1}$ ION TO Mn^{+2}



a. 96500C

b. 482500C

c. 203000C

d. 48250C

EXPLANATION:

$$MnO_4^{-1} \xrightarrow{5e^-} Mn^{+2}$$

O.S OF Mn IS +7 *A*ND CHANGE IS +7 TO +2

1 MOLE OF MnO^{-1} REQUIRES **5** MOLES OF e-

TRANSFER OF 1 MOLE OF e-

96500c REQUIRED

TRANSFER 5 MOLES OF e-

96500x5=

482500c

REQUIRED

ANS: b

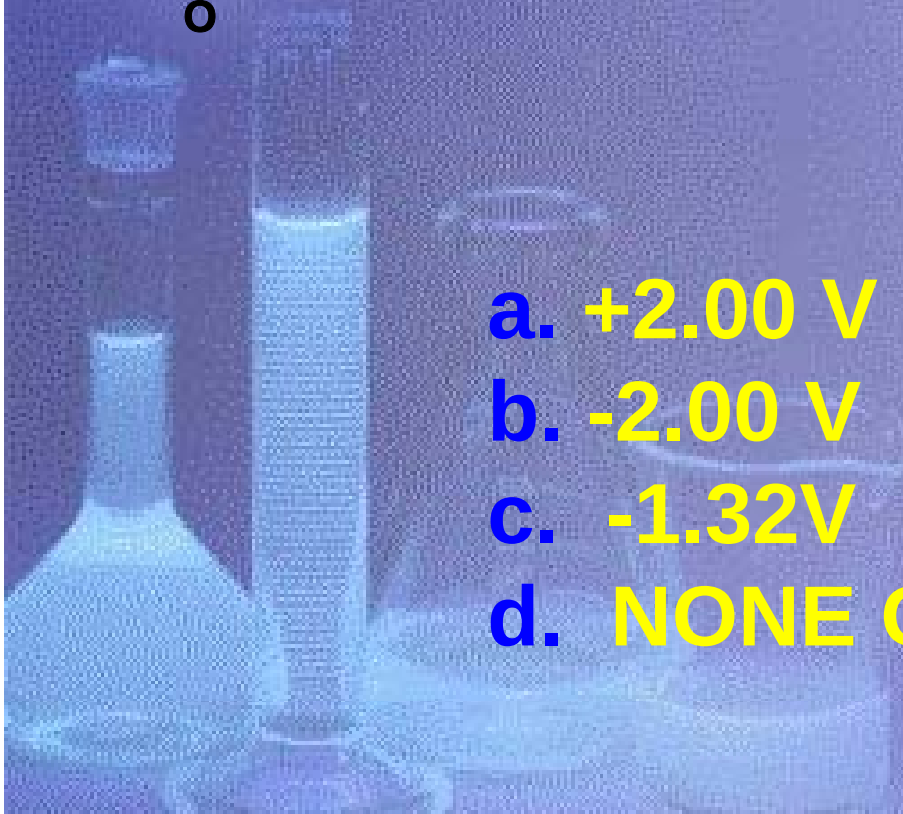
Q-2. ZINC CAN DISPLACE COPPER FROM COPPER SULPHATE SOLUTION BECAUSE,

1. **REDUCTION POTENTIAL OF ZINC IS HIGH.**
2. **REDUCTION POTENTIAL OF ZINC IS LOW**
3. **REDUCTION POTENTIAL OF COPPER IS LESS**
4. **NONE OF ABOVE.**

IN THE ELECEROCHEMICAL SERIES ELEMENTS ARE ARRANGED IN THE INCREASING ORDER OF THEIR STANDARD REDUCTION POTENTIAL. THE ELEMENT WHICH IS PLACED ABOVE WILL DISPLACE THE ELEMENT BELOW TO IT.

ANS: 2

Q-3. WHAT IS THE EMF OF A VOLTAIC CELL CONSTRUCTED BY USING STANDADRD ALUMINIUM ELECTRODE AND STANDADRD COPPER ELECTRODE, E^{o}_{Al}=-1.66V and E^{o}_{CU}=+0.34 V



a. +2.00 V
b. -2.00 V
c. -1.32V
d. NONE OF ABOVE

EMF OF A CELL IS DEFINED AS A FORCE TO DRIVE e- s TO OUTER CIRCUIT THROUGH ANODE TO CATHODE

$$EMF = E^{\circ}_{right} - E^{\circ}_{left}$$

$$= E^{\circ}_{cu} - E^{\circ}_{Al}$$

$$= 0.34 - (-1.68)$$

$$= +2.00V$$

ANS : a

Q-4. FOR PREPARING BUFER SOLUTION OF PH=4.8 USING AN ACID OF Pka=4.5, THE RATIO OF (SALT)/(ACID) TO BE TAKEN AS,

a. 2
b. 0.5
c. 0.3
d. 3

W.K.T THE HENDERSONS EQUATION IS GIVEN BY

$$PH = Pka + \log \frac{[SALT]}{[ACID]}$$

$$\log \frac{[SALT]}{[ACID]} = 0.3$$

$$\frac{[SALT]}{[ACID]} = \text{ANTI LOG } 0.3$$

$$\frac{[SALT]}{[ACID]} = 2$$

ANS = a

Q-5. THE STANDARD ELECTRODE POTENTIAL IS MEASURED BY

a. VOLTMETER
b. PYROMETER
c. GALVANAMETER
d. AMMETER

ANS: VOLTMETER

Q-6. STRONGER THE OXIDISING AGENT GREATER THE

a. REDUCTION POTENTIAL

b. OXIDATION POTENTIAL

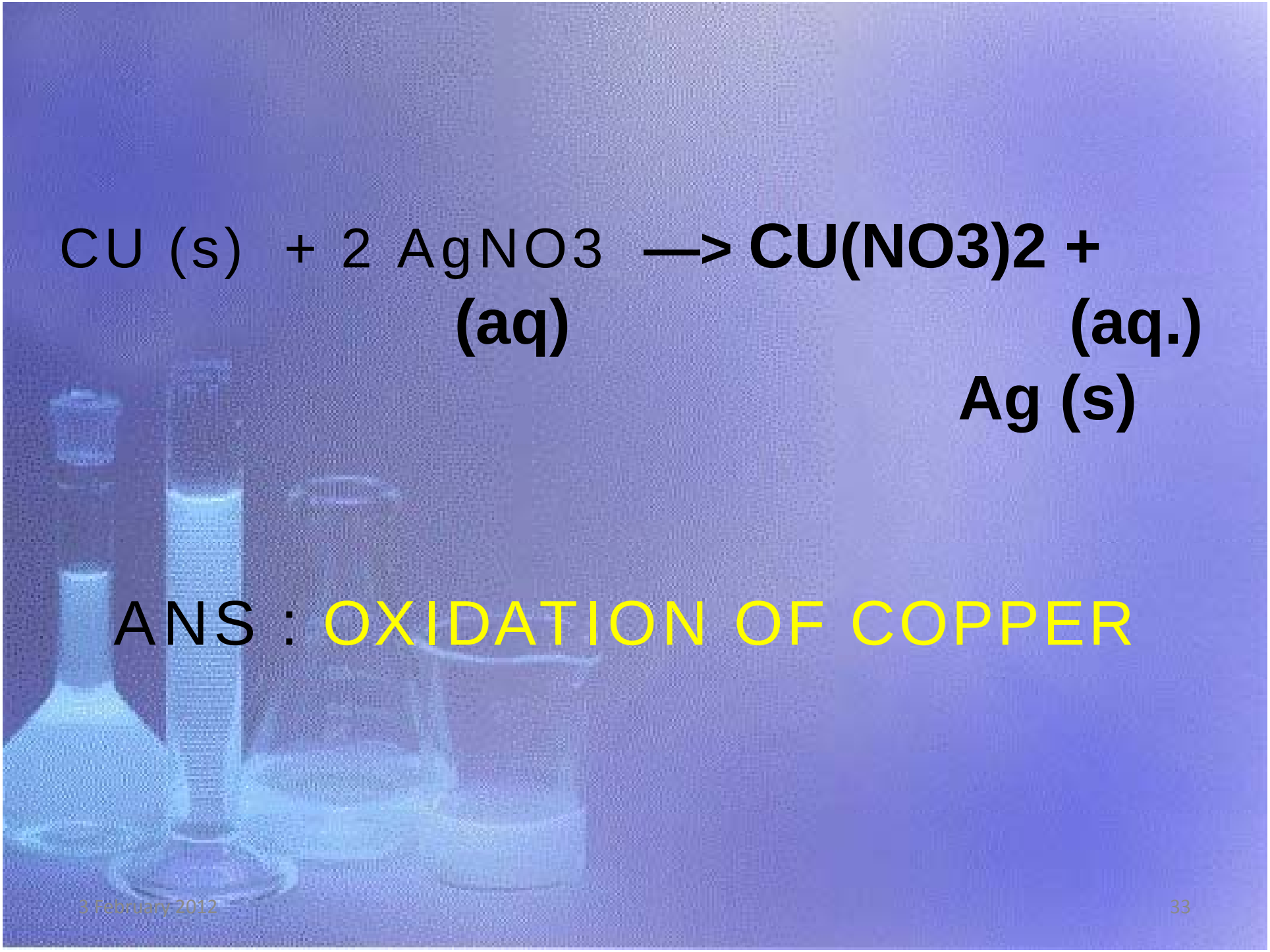
C. IONIC BEHAVIOUR

d. NONE OF ABOVE

ANS : REDUCTION POTENTIAL

Q-7 : WHEN A PIECE OF COPPER WIRE IS IMMERSED IN A SOLUTION OF SILVER NITRATE, THE COLOR OF THE SOLUTION IS BLUE. THIS IS DUE TO,

a. OXIDATION OF COPPER
b. REDUCTION OF COPPER
c. FORMATION OF SOLUTE COMPLEX
d. OXIDATION OF SILVER



CU (s) + 2 AgNO3 —> **CU(NO3)2 +**
(aq) (aq.)
Ag (s)

ANS : OXIDATION OF COPPER

Q-8 PREVENTION OF CORROSION OF IRON BY ZINC COATING IS CALLED

a. GALVANISATION
b. CATHODIC PROTECTION
c. PAINTING
d. TINNING

ANS : GALVANISATION

COATING WITH ZINC

Q9 . ON PASSING 3 amp OF ELECTRICITY FOR 50 min. 1.8g OF METAL DEPOSITS. THE EQUIVALENT WEIGHT OF METAL IS

a. 20.5
b. 25.8
c. 19.3
d. 30.7

W.K.T FROM I LAW OF FARADAY,

$$Q = I \times t$$

$$= 3X50X60 \text{ amp.s}$$

$$= 9000 \text{ C}$$

9000C CAN DEPOSIT 1.8g OF metal

96500C CAN DEPOSIT $\frac{96500 \times 1.8}{9000}$

THE EQUIVALENT WEIGHT OF METAL

19.3

ANS: C

Q10.IN ELECTROPLATING THE ARTICLE TO BE ELECTROPLATED SERVES AS,

a. CATHODE
b. ELECTROLYTE
c. CONDUCTOR
d. ANODE

ANS : CATHODE

Q11: IN GALVANIC CELLS,

a. ELECTRICAL ENERGY IS CONVERTED TO CHEMICAL ENERGY
b. CHEMICAL ENERGY IS CONVERTED INTO ELECTRICAL ENERGY
c. CHEMICAL ENERGY INTO HEAT ENERGY
d. ELECTRICAL ENERGY INTO HEAT ENERGY

ANS : CHEMICAL ENERGY IN TO ELECTRICAL ENERGY

Q12: PH OF A 0.OO5M AQUEOUS Ca(OH)2 IS

a. 12

b. 2

c. 9

d. 0.005

EXPLANATION : (di acedic base)

$Ca(OH)2 \longrightarrow Ca^{+2} + 2(OH^{-})$

$2[OH^{-}] = 2 \times O.OO5$

$= O.O1$ mol./dm3

$[OH^{-}] = O.OI$ mol./dm3

$POH = -Log\ [OH^{-}]$

$= 2$

$PH = 14 - 2$

$= 12$ **ANS: a**

Q13:THE HYDROGEN ION CONCENTRATION OF O.2 M CH3COOH WHICH IS 40% DISSOCIATED IS ,

a. O.O8 M

b. O.12 M

c. O.8 M

d. O.4 M

EXPLANATION: BASED ON OSTWALD'S DILUTION LAW, IT GIVES THE RELATIONSHIP BETWEEN DEGREE OF DISSOCIATION WITH DILUTION

$[H^+] = \propto C$

$= 40/100 \times 0.2$

$= 0.08$ mol./dm3

ANS : a

Q14: IN WHICH OF THESE SOLUTIONS AgCl HAS MAXIMUM SOLUBILITY ?

a. O.1M HCL

b. WATER

c. O.1M NaCL

d. O.1M NH4OH

SOLUTION :

IN O.1MHCl AND O.1M NaCl SOLUBILITY DECREASES DUE TO COMMON ION EFFECT. IN NH4OH SOLUBILITY INCREASES DUE TO COMPLEX FORMATION .

AgCl + 2 NH4OH —> [Ag(NH3)2] CL + H2O

ANS: d

Q15: WHICH OF THE FOLLOWING IS A WEAKEST ACID?

a. Pka= 3.75 **b. Pka= 4.75**

c. Pka= 4.25 **d. Pka=3.20**

LOWER THE ka VALUE, WEAKER THE ACID AND HIGHER THE Pka VALUE

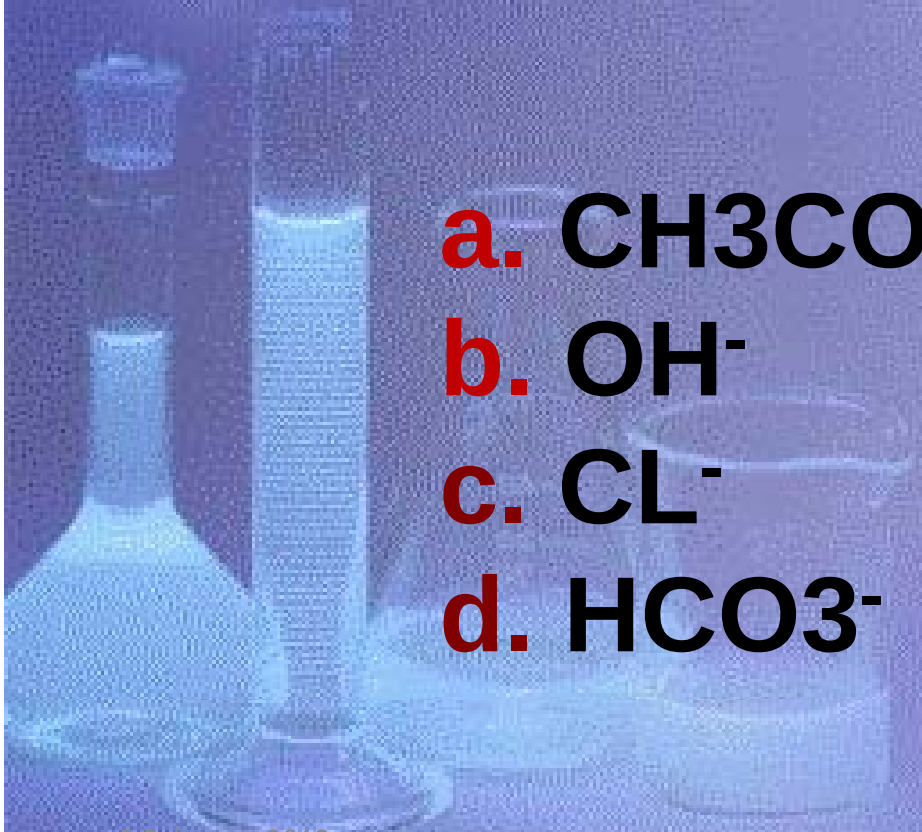
ANS : b

Q16: WHICH ONE OF THE FOLLOWING IS NOT A LEWIS ACID ?

a. $AlCl_3$
b. $FeCl_3$
c. BF_3
d. CH_3COOH

ANS: d (NOT e- DIFFICIENT) WHICH IS BRONSTED ACID

Q17. AMONG THESE THE STRONGEST BRONSTED BASE IS,



a. CH_3COO^-
b. OH^-
c. CL^-
d. HCO_3^-

EXPLANATION :

FIND OUT THE RESPECTIVE ACID BY ADDING ONE PROTON TO EACH THEN WE GET

CH_3COOH, H_2O, HCl, H_2CO_3

HERE H_2O IS WEAKEST ACID, WEAKER THE ACID STRONGER THE BRONSTED BASE

ANS: b

Q-18. THE PRODUCT OF AMPERE AND TIME IN SECONDS IS EQUAL TO THE NUMBER OF ,

a. COULOMBS TRANSFERRED
b. e^-s TRANSFERRED
c. FARADAYS TRANSFERRED
d. VOLTS

ANS : a

Q-19. WHICH OF THE THESE DOES NOT ACT AS A BRONSTED ACID.

a. NH_4^+
b. HCO_3^-
b. CH_3COO^-
c. HSO_3^-

HERE WE SEE FOR PROTON DONORS, SO CH_3COO^- DOES NOT HAVE PROTON TO DONATE SO IT IS NOT A BRONSTED ACID

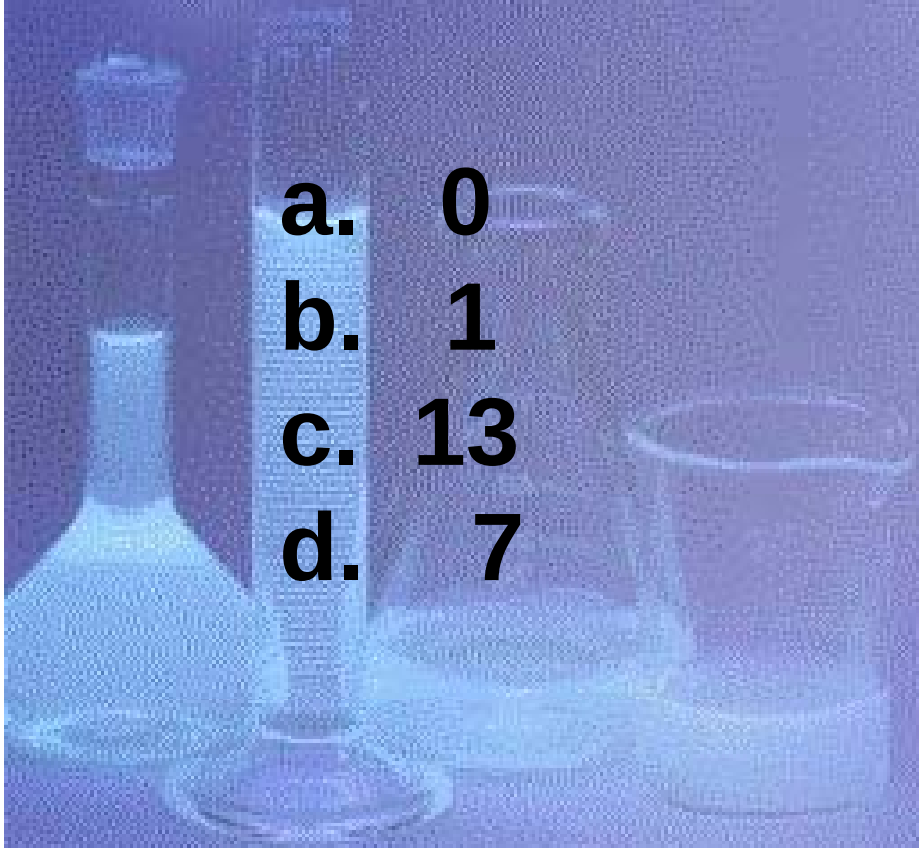
ANS: C

Q-20. THE ELECTROLYTIC CONDUCTANCE IS A DIRECT MEASURE OF

a.RESISTANCE
b.POTENTIAL
c.CONCENTRATION
d.DISSOCIATION

ANS-d

Q21. WHEN 500ml OF O.11M NaOH AND O.O1MHCl ARE MIXED, THE PH OF THE MIXED SOLUTION IS,



a. 0
b. 1
c. 13
d. 7

LET US FIND OUT THE NUMBER OF EQUIVALENTOF NaOH LEFT UNUSED PER LITRE.

THE NUMBER OF EQUIVALENTS OF NaOH REMAINING

$$= \frac{500 \times o.II}{1000} - \frac{500 \times O.O1}{1000} = O.O5 \text{ mol./dm3}$$

[OH-] = O.O5, POH= 1.3, PH=14- 1.3=12.7

Q22. THE DISSOCIATION CONSTANTS OF A WEAK ACID AND BASE CONSTITUTING A SALT ARE EQUAL . THE PH OF THE SALT SOLUTION WILL BE

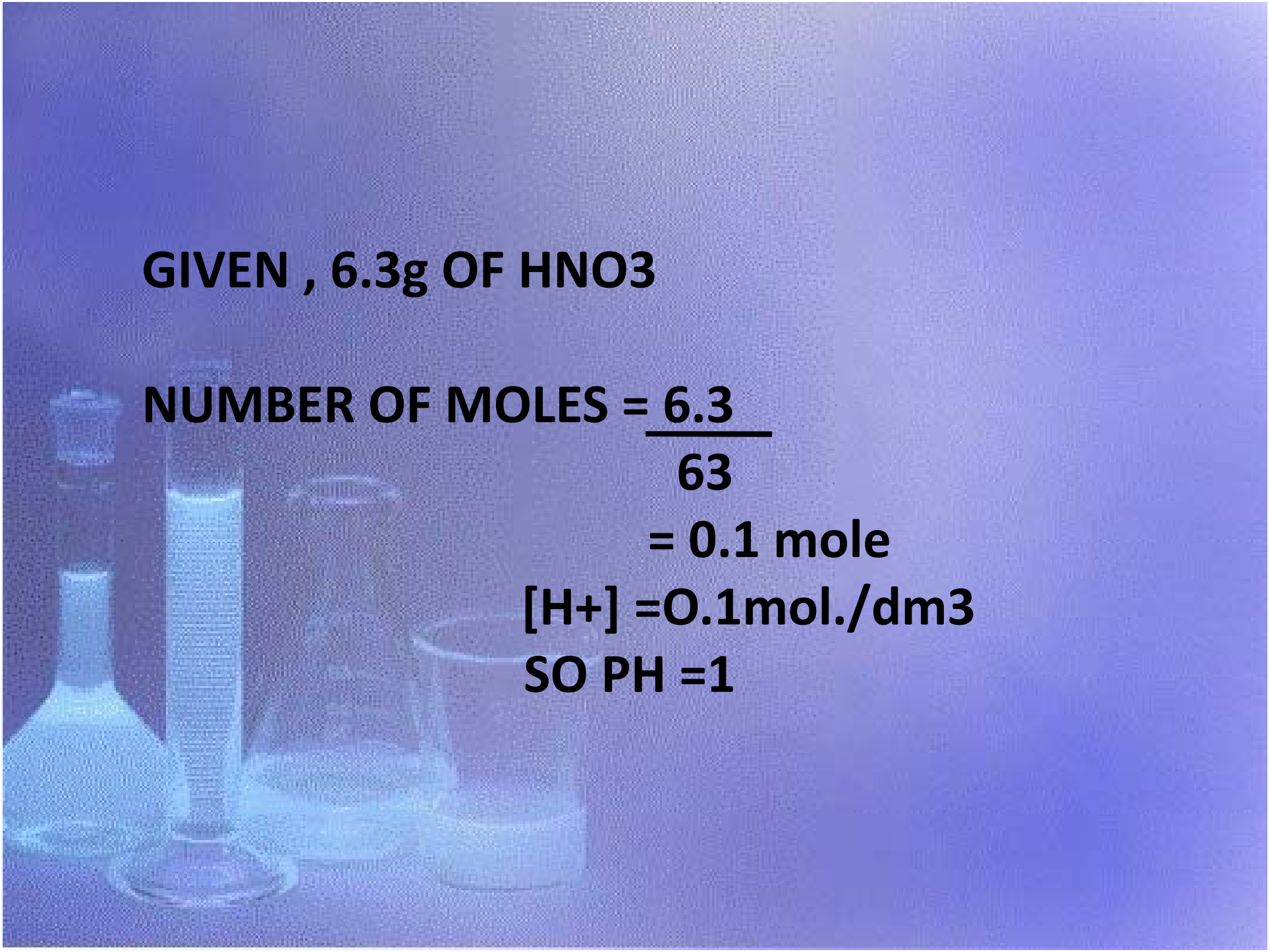
1. EQUAL TO SEVEN
2. MORE THAN SEVEN
3. LESS THAN EVEN
4. CAN NOT CONCLUDE

SALT OF WEAK ACID AND WEAK BASE ON HYDROLYSIS PRODUCE WEAK ACID AND WEAK BASE, AND DISSOCIATION CONSTANTS ARE EQUAL . THEREFORE, $[H^{+}] = [OH^{-}]$ AND PH=7

ANS: I

Q23. NITRIC ACID HAS A MOLECULAR MASS 63. IF 6.3g OF IT IS PRESENT DISSOLVED IN A LITRE SOLUTION ITS PH IS,

a. 10
b. O.1
c. 1.O
d. O.O1



GIVEN , 6.3g OF HNO_3

NUMBER OF MOLES = $\frac{6.3}{63}$

= 0.1 mole

$[H^+]$ =O.1mol./dm3

SO PH =1

Q24. THE RATIO OF MASS OF HYDROGEN LIBERATED AND MEGNESIUM DEPOSITED BY THE SAME AMOUNT OF ELECTRICITY FROM H_2SO_4 AND $MgSO_4$ IS,

A. 1:8
B. 1:12
C. 1:16
D. 1 :32

ANS: B


THANK U STUDENTS
ALL THE BEST
WISHES