

**AFTER YEARS OF OBSERVATIONS
AND FEED BACK, TEAM**

EQUIPTRONICS®

**HAVE PRODUCED THIS
HANDBOOK FOR BENEFIT OF
STUDENTS. WE ARE PLACING
BEFORE YOU SOME OF THE
COMMON MISTAKES DONE BY
STUDENTS WHICH AFFECTS
THEIR PERFORMANCE IN
PRACTICALS EXAMS.
WORKING PRINCIPLE OF SOME
COMMON LAB INSTRUMENTS
ARE ALSO EXPLAINED IN
SIMPLE FORMAT.**

For any difficulty contact us on info@equiptronics.com

LIST OF ALL OUR PRODUCTS

- SPECTROPHOTOMETER
- POLARIMETER
- FLAME PHOTOMETER
- DIGITAL PHOTO FLORIMETER
- DIGITAL BECKMAN THERMOMETER
- DIGITAL pH METER
- DIGITAL CONDUCTIVITY METER
- DIGITAL ORP METER
- DIGITAL TDS METER
- DIGITAL COLORIMETER
- DIGITAL POTENTIO METER
- pH - TITRATOR
- POTENTIO - TITRATOR
- MAGNETIC STIRRERS
- SERVO VOLTAGE STABLIZER
- DIGITAL TURBIDITY METER
- ELECTROPHORESIS POWER SUPPLY
- ELECTROPHORESIS APPARATUS
- ELECTRO GRAVIMETRIC APPARATUS
- DIGITAL BOILING/MELTING POINT APPARATUS
- DIGITAL STOP CLOCK
- DIGITAL INTERVAL METER
- UV TRANS ILLUMINATOR
- ELECTRODES
- UV CABINET
- D.O. METER
- AUTO BURETTE
- KARL - FISHER TITRATOR

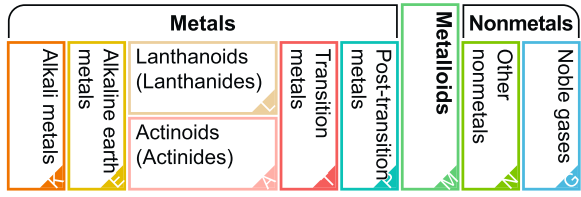
Email: info@equiptronics.com | Website: www.equiptronics.com

Periodic Table

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18

1 H Hydrogen 1.008	Atomic # Symbol Name Weight	
3 Li Lithium 6.94	4 Be Beryllium 9.0122	
11 Na Sodium 22.990	12 Mg Magnesium 24.305	
19 K Potassium 39.098	20 Ca Calcium 40.078	
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	
55 Cs Caesium 132.91	56 Ba Barium 137.33	
87 Fr Francium (223)	88 Ra Radium (226)	

C	Solid
Hg	Liquid
H	Gas
Rf	Unknown



5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
13 Al Aluminium 26.982	14 Si Silicon 28.085	15 P Phosphorus 30.974	16 S Sulfur 32.06	17 Cl Chlorine 35.45	18 Ar Argon 39.948

21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.630	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 83.798	
39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29	
57-71		72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
89-103		104 Rf Rutherfordium (267)	105 Db Dubnium (268)	106 Sg Seaborgium (269)	107 Bh Bohrium (270)	108 Hs Hassium (277)	109 Mt Meitnerium (278)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (282)	112 Cn Copernicium (285)	113 Nh Nihonium (286)	114 Fl Flerovium (289)	115 Mc Moscovium (290)	116 Lv Livermorium (293)	117 Ts Tennessine (294)	118 Og Oganesson (294)

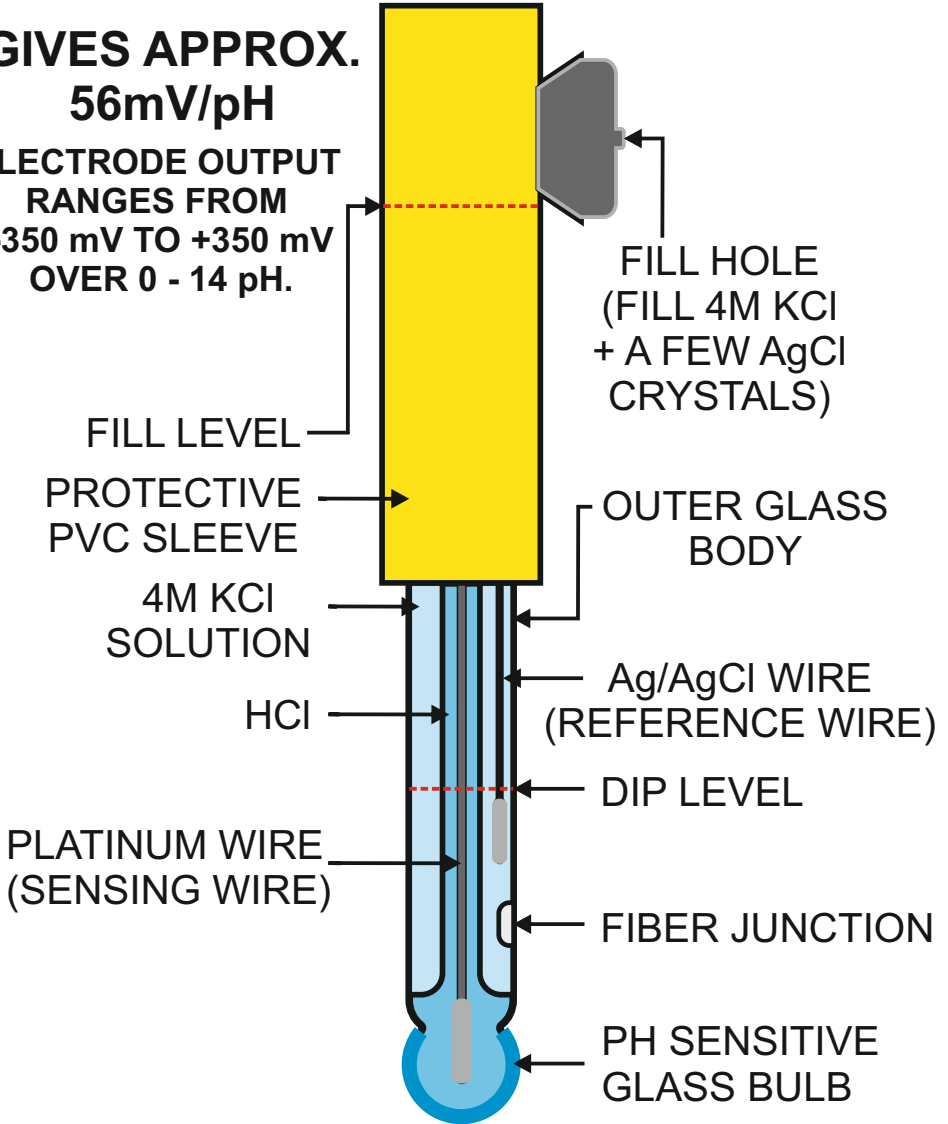
For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

6	57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97
7	89 Ac Actinium (227)	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (266)

UNBREAKABLE APH SLEEVED GLASS + REFERENCE COMBINED pH ELECTRODE

**GIVES APPROX.
56mV/pH**

**ELECTRODE OUTPUT
RANGES FROM
-350 mV TO +350 mV
OVER 0 - 14 pH.**

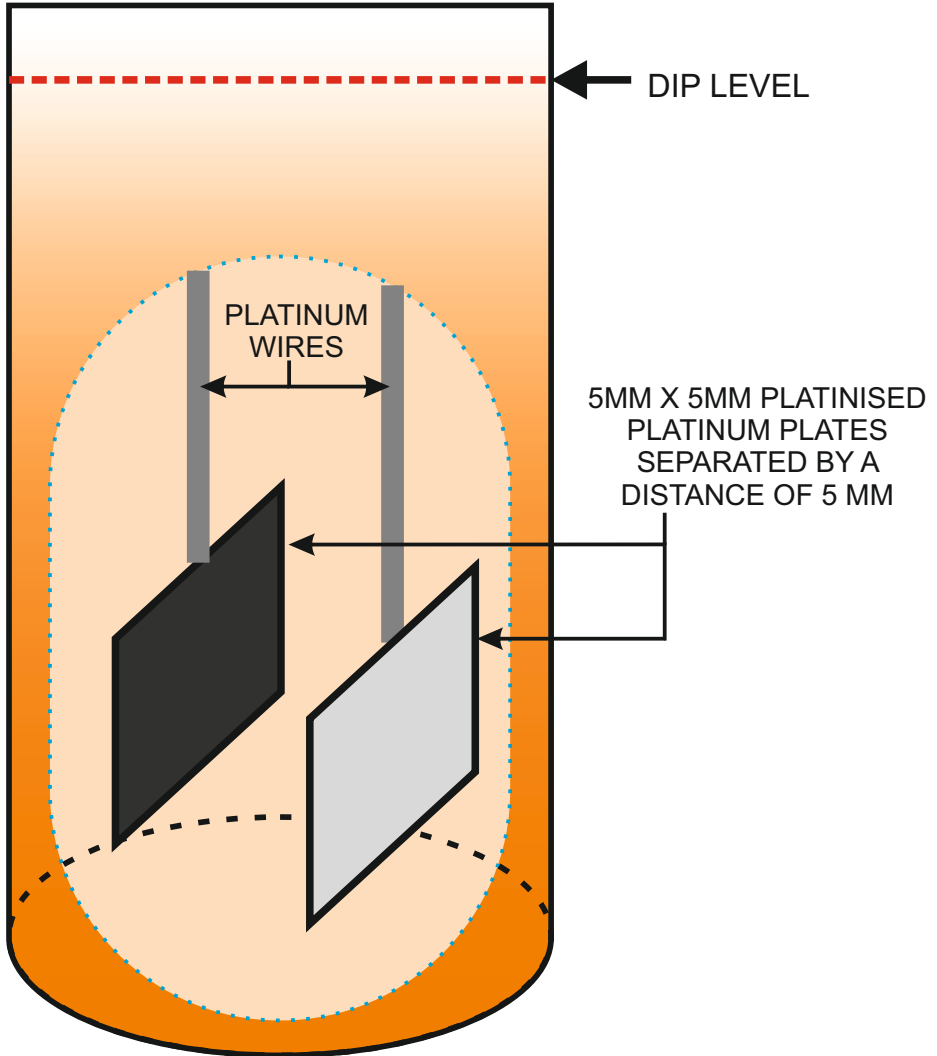


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UNBREAKABLE APH SLEEVED CONDUCTIVITY CELL

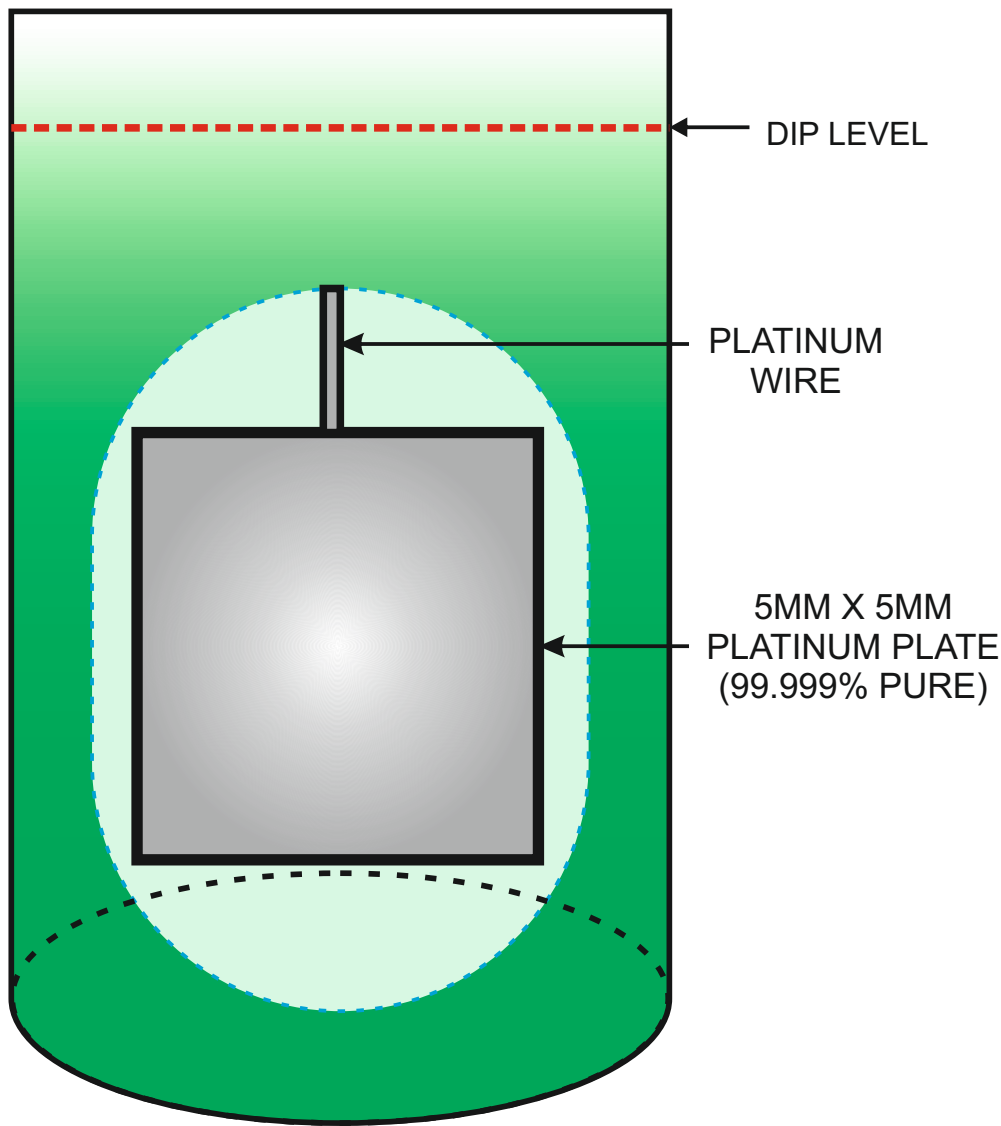


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UNBREAKABLE APH SLEEVED PLATINUM ELECTRODE WITH **25 MM²** **PLATINUM PLATE FOR ENHANCED READINGS**

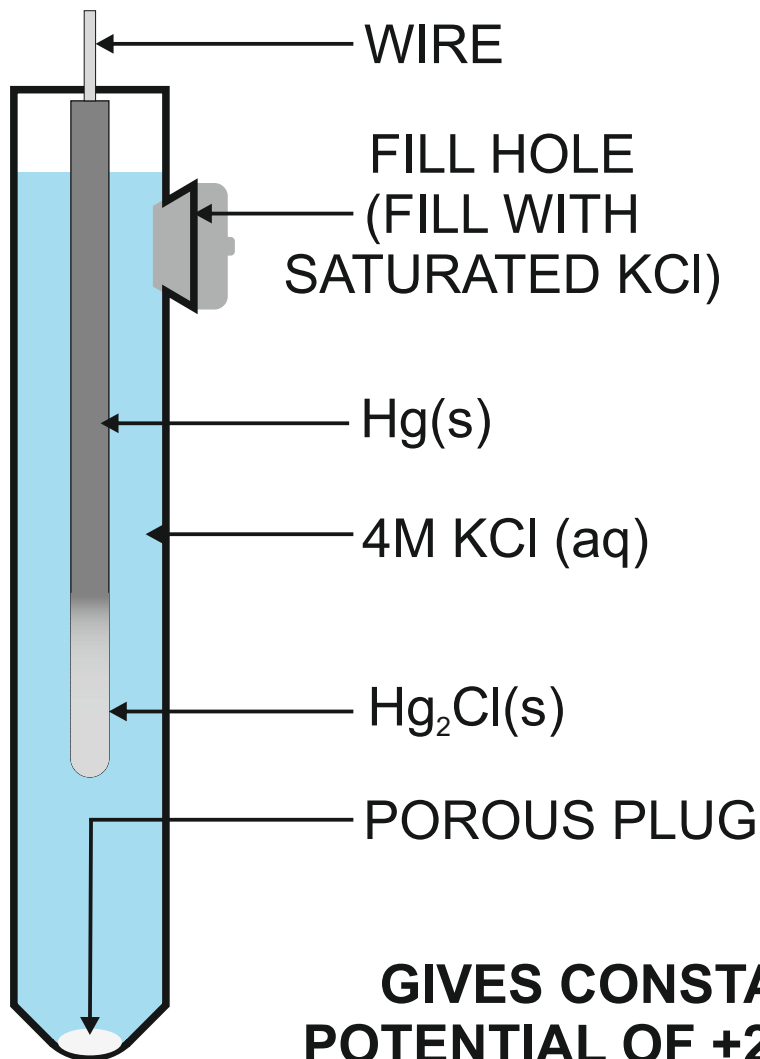


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UNBREAKABLE APH SLEEVED REFERENCE ELECTRODE (CALOMEL ELECTRODE/ Hg-Hg₂Cl₂)



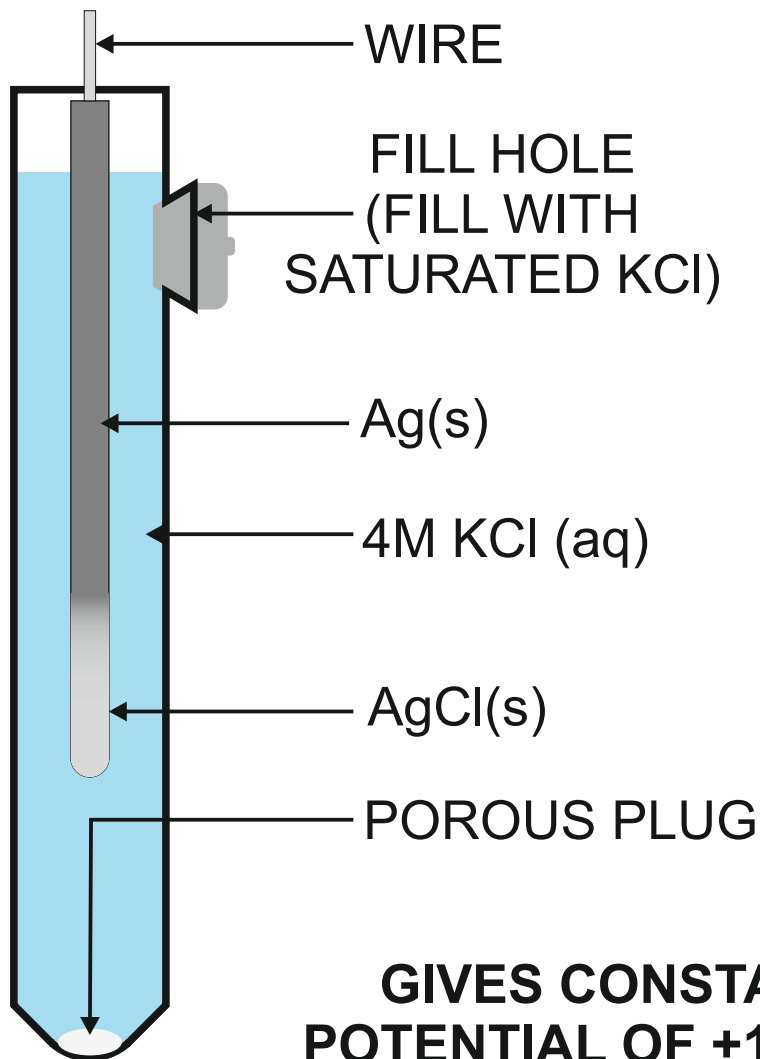
**GIVES CONSTANT
POTENTIAL OF +241 mV
WITH RESPECT TO S.H.E.**

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UNBREAKABLE APH SLEEVED REFERENCE ELECTRODE (Ag-AgCl)



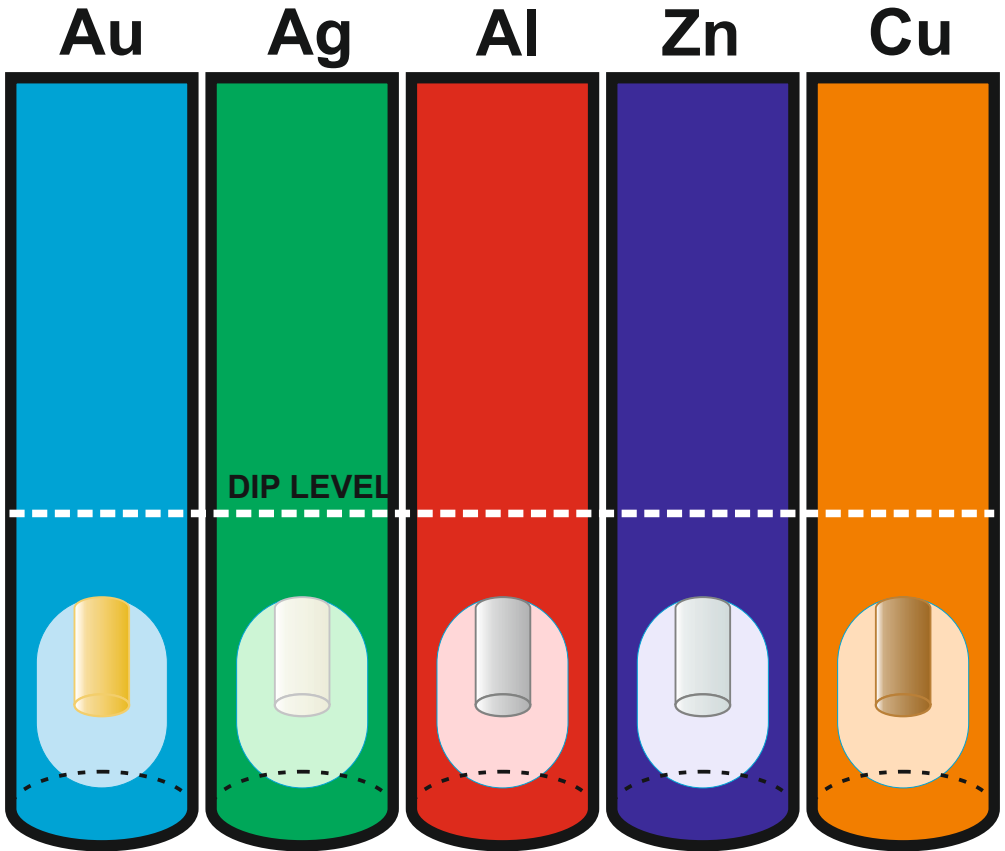
**GIVES CONSTANT
POTENTIAL OF +197 mV
WITH RESPECT TO S.H.E.**

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METALLIC ELECTRODES (GOLD, SILVER, ALUMINUM, ZINC, COPPER)



WE USE 99.99% PURE METALS FOR ALL OUR METALLIC ELECTRODES FOR BEST ACCURACY IN READINGS. THE ELECTRODES HAVE A LARGE SURFACE AREA. ELECTRODES SHOULD NOT BE MADE FROM COMMERCIAL GRADE METALS. THEY ARE VERY MUCH IMPURE AND THEY HAMPER THE RESULTS.

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HEALTH AND HYGENIE OF ELECTRODE

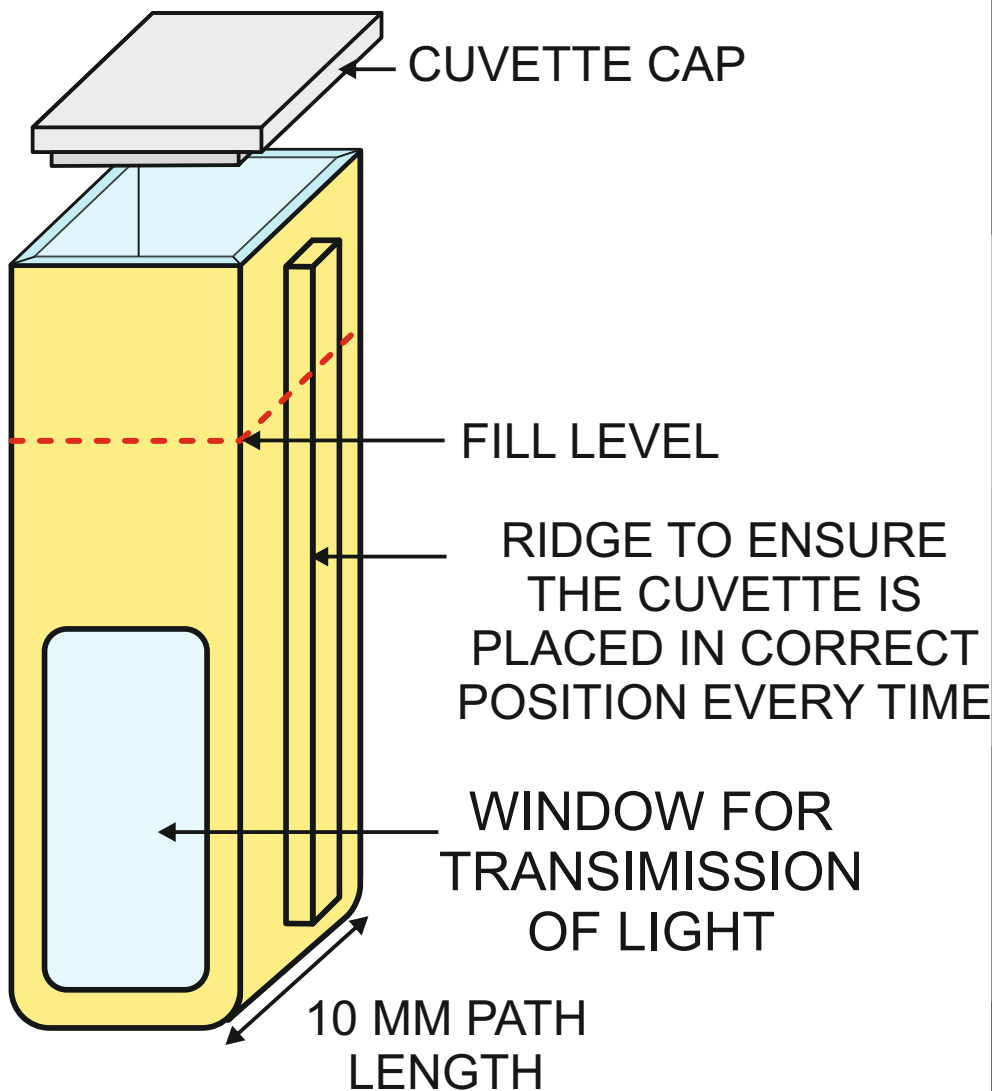
1. Check the level of KCl. Add freshly prepared, 4M KCl + a few crystals of AgCl. The KCl has to flow out of fibre junction freely. The KCl solution should be replaced weekly with freshly prepared solution.
2. Fluctuations may occur due to the moisture present in the air. Clean both BNC pin and socket of electrode with alcohol using small brush. Blow dry with air dryer.
3. To clean the electrode, unscrew the protective sleeve of the electrode and dip the bare glass electrode in 1N HCl acid for 5 minutes and remove. Immediately wash under running water and wipe with tissue paper.
4. Always keep the protective sleeve on the electrode. It prevents breakage and also damage to the delicate glass bulb.
5. Keep your electrode in long term storage with the wetting cap on. Fill the cap with enough 4M KCl solution to cover the glass bulb.
6. The filling solution (4M KCl + few AgCl crystals) is to be replenished if level goes down. It must be filled till fill hole.
7. DO NOT store the electrode in distilled water. Always use acidified water (a few drops of acid in 250 mL of water).
8. DO NOT use electrode outside pH (0 to 14) and temperature (0° to 75° C) ranges.

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APH JACKETED SPECTROPHOTOMETER CUVETTE OF 10 MM PATH LENGTH (GLASS/QUARTZ)



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BEER LAMBERTS' LAW

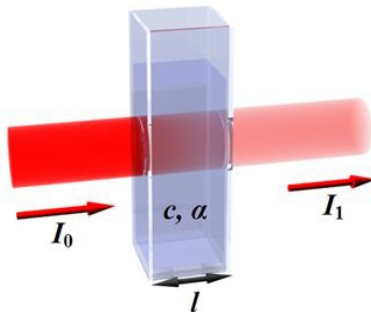
Beer-Lambert Law

$$A = \epsilon b C$$

Where A = absorbance, ϵ = molar extinction coefficient, b = path length (1cm), and C = concentration.

$$A = -\text{Log}(T) \text{ (Note } 0 < T < 1)$$

$$T = I_1 / I_0$$

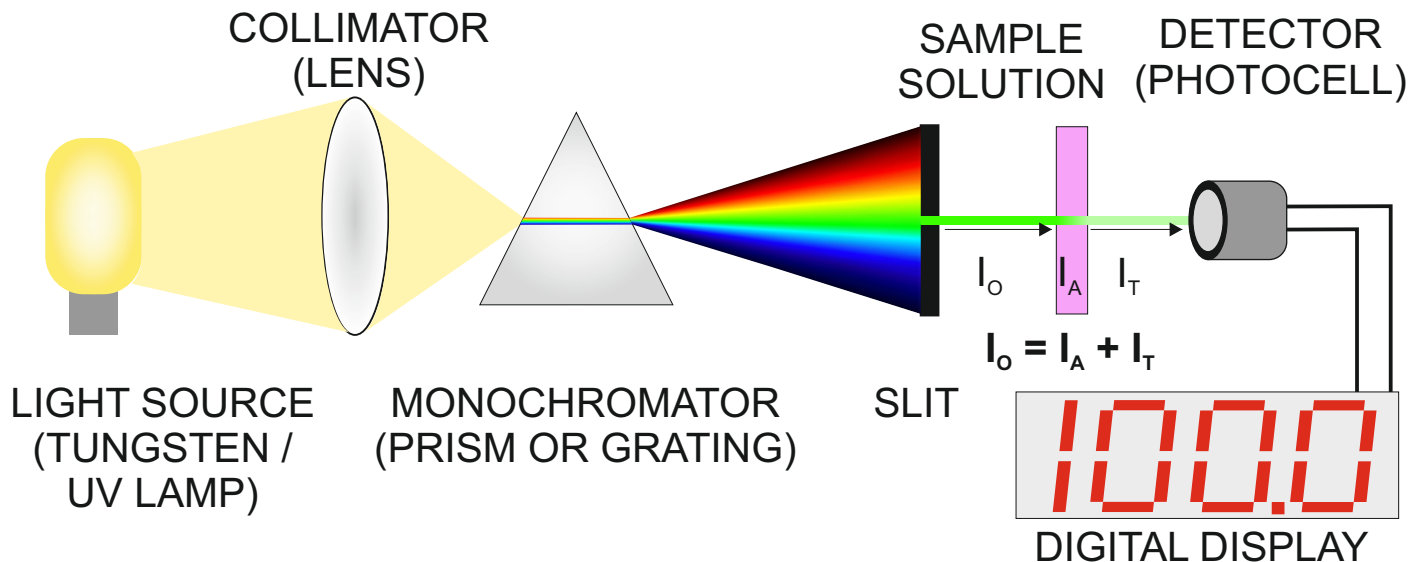


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SPECTROPHOTOMETER PRINCIPLE



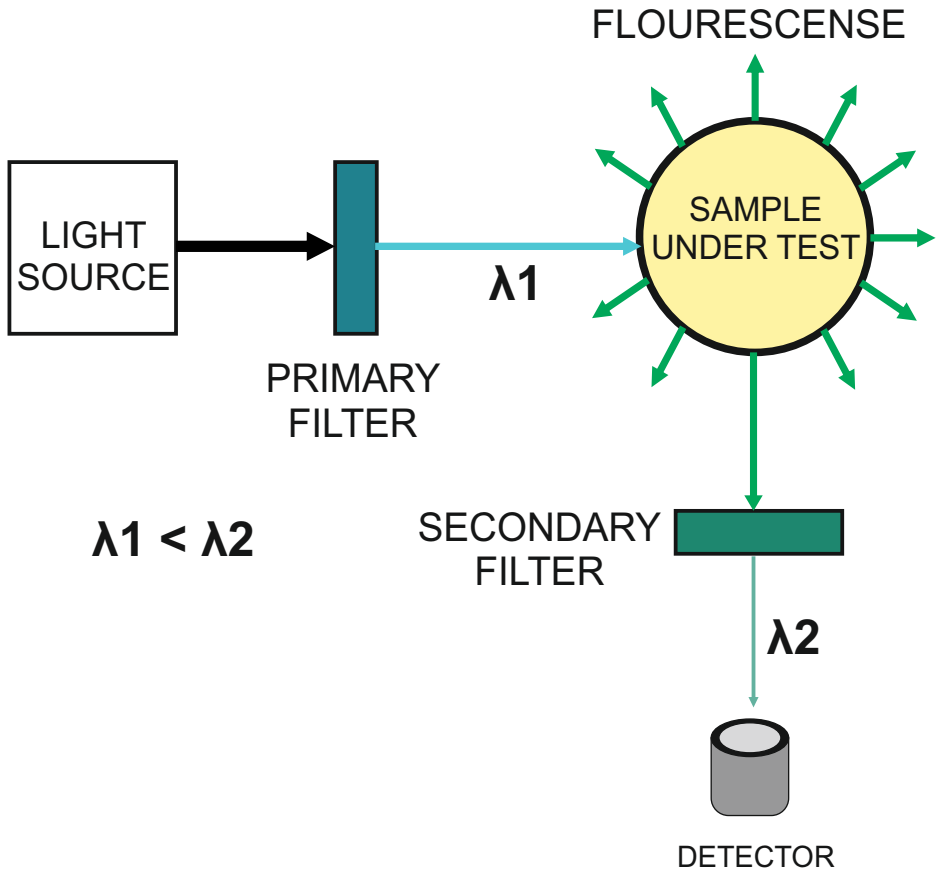
$$\text{ABSORBANCE (A)} = \log_{10} (I_0/I_T)$$

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PRINCIPLE OF PHOTOFLOURO METER

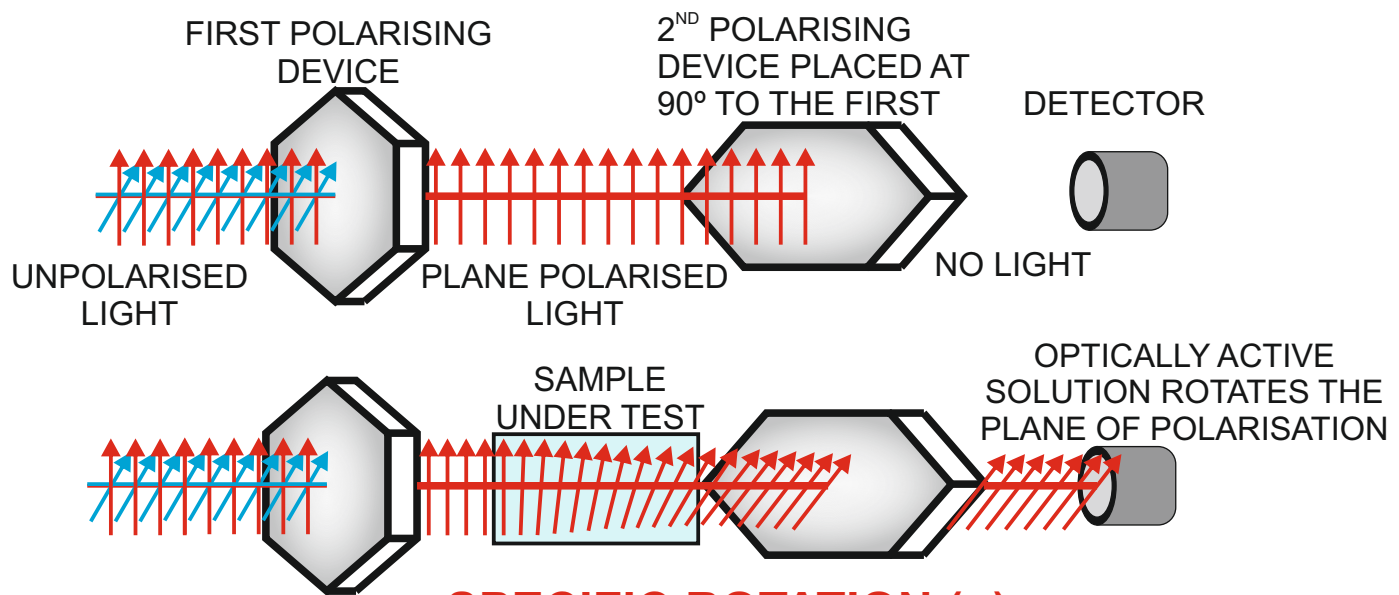


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POLARIMETRY PRINCIPLE



SPECIFIC ROTATION (α)

$$\alpha = \frac{\text{ANGLE OF ROTATION}(\theta) \times 100}{(\text{PATH LENGTH} \times \text{CONCENTRATION (gm/mL)})}$$

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POLARIMETER TIPS

1. The polarimeter tube should be thoroughly rinsed with water before use. Both the side glasses should be removed, washed and then placed back. The cap should be screwed on tightly.
2. The solution has to be filtered to remove any suspended particles.
3. The tube should be rinsed with the solution under test, discarded and then again filled with the solution.
4. The side glasses should be stain free. They should be changed when stained.
5. The sample solution should be homogenous. To achieve homogeneity it must be stirred for 1 hour.
6. Before pouring the solution in the polarimeter tube, the user should ensure that both the end caps are tightly secured. The solution should be poured in through the neck of the tube.
7. After pouring a little solution in the tube, the user should tilt the tube sideways to remove any bubbles, then again resume pouring. The tube should be filled up to the neck.
8. After securing the top cap, the user has to look into the tube through the side glasses to ensure that no bubble is present in path of light. If any, should be removed by tilting the tube sideways.

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POLARIMETER TIPS

(continued)

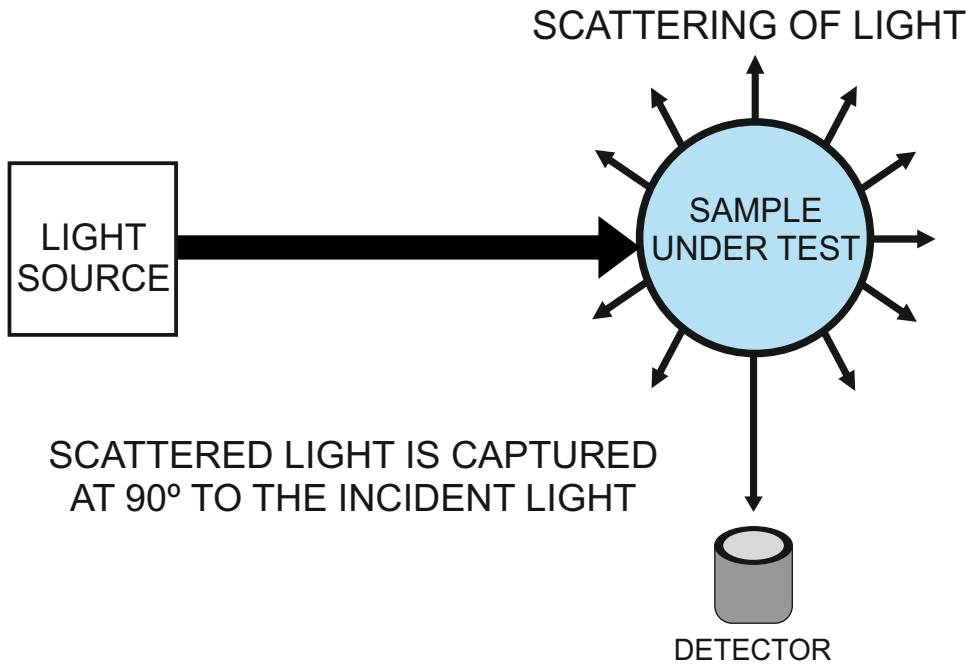
9. The user should set the tube aside for 10 to 15 minutes so that the solution settles down. The solution should be crystal clear without any waves.
10. The accuracy of the reading depends on the fine catching of the minimum intensity of light. The wheel should be rotated very slowly using the index finger while observing the intensity on the meter with the help of the magnifying lens.

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TURBIDITY PRINCIPLE



SCATTERING OF LIGHT IS DIRECTLY PROPORTIONAL TO THE NO. OF SUSPENDED PARTICLES PRESENT IN THE SAMPLE. THE UNIT OF TURBIDITY IS NTU.

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PREPARATION FOR PRACTICALS (After vacation or before exams).

A few days prior to start of practicals or examination, these things have to be ensured/done:

1. Availability of enough quantity of distilled water for the experiments.
2. Availability of AR grade chemicals.
3. Condition of electrodes (whether they are broken or damaged, etc).
4. Freshly prepared 4M KCl + (a few crystals of AgCl) solution to be filled in pH and potentiometer electrodes.
5. All instruments are to be calibrated with their respective electrodes using the calibrations or buffer solutions (they are to be prepared with distilled water only).
6. Keep the instrument switched ON for at least six hours.
7. Cuvettes for colorimeter, spectrophotometer and photofluorimeter have to be cleaned in concentrated HCl, then rinsed with water and dried.
8. Polarimeter side glasses have to be washed with detergent. Ensure no stains remain.
9. At least 3-4 good, functioning, spare electrodes and 1-2 spare instruments should be available, in case the electrodes break during the experiments.

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GOOD LABORATORY PRACTICES

1. Wash the electrodes before and after use. Store only in box provided.
2. Rinse the electrodes with water between uses.
3. Rinse the cuvettes, test-tubes, etc with solution under test and discard the solution.
4. Do not hold the cuvettes from their transparent sides as finger prints will alter the readings.
5. Put cuvette cap on to avoid spillage
6. Ensure electrode is dipped till dip level. Add distilled water to raise level.
7. All weight balances, burettes, pipettes, etc have to be calibrated.
8. In case of power failure only use sine wave inverter. Use instruments with battery backup.
9. During titration, wait for atleast 10 seconds to record the reading after dispensing the titrant and stirring the solution.

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COMMON MISTAKES

1. Dipping electrodes in distilled water for cleaning or storage purposes.
Electrodes should be kept in acidified water only.
2. Electrodes are not immersed adequately in the solution.
The bottom $\frac{1}{3}$ rd of the electrode (tip and fiber junction) must be compulsorily submerged well under the solution.
3. Fluctuation in readings, if occurs, is 95% due to improper or ill conditioned electrodes.
Ensure that electrodes are good and in functioning condition.
4. Continuing to use bad or broken electrodes.
E.g.: Conductivity cell plates are broken.
Change electrode.
Broken AgCl wire in reference electrodes.
Change electrode.
Using of pH, potentiometer and reference electrodes even after KCl inside has turned milky.
Immediately change KCl. If possible, KCl has to be changed weekly.
Electrode are dry (KCl has dried up).
Fill with freshly prepared KCl.
5. Corrosion at pin and connector of electrodes.
Should be cleaned with sandpaper.
6. Buffers solutions are old.
Prepare fresh buffer solutions for calibration.

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COMMON MISTAKES (continued)

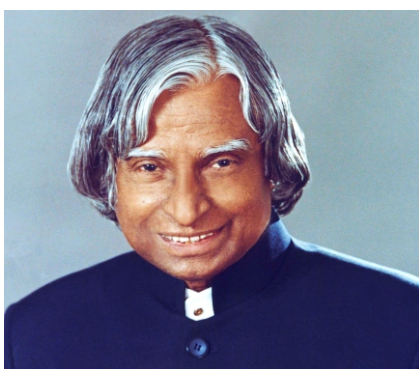
- 7. Using electrode as a stir rod.**
Use glass rod or magnetic stirrer.
Homogeneity in solution must be achieved before recording the readings.
- 8. Incorrect or inappropriate range selected in conductivity meter.**
Range selected should be such that the reading covers all the 4 digits of the display.
- 9. Filter selection wheel in colorimeter is not turned fully.**
Ensure that the wheel clicks into place every time a filter is selected.
- 10. Spectrophotometer cuvettes are placed incorrectly in the instrument.**
The transparent side of the cuvette should be in path of the light.
- 11. Cuvettes are stained.**
Cuvettes should be clean, dry and spotless. Clean with concentrated HCl or nitric acid if stained.
- 12. Test tubes, cuvettes, etc are not matched.**
Always use the test tubes or cuvettes provided with the instrument. Using any other cuvettes or test tubes will hamper the results.

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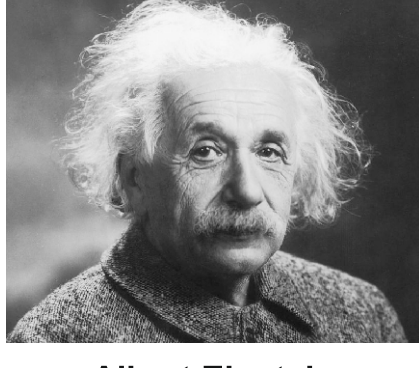
ICONS to drive inspiration from



A. P. J. Abdul Kalam
placed India in elite club of
countries having missile
technology



DR. C.V. Raman
first indian to join super
club of Nobel Laureate



Albert Einstein
changed the world of
Physics forever



Curie Family
3 people 4 Noble Prizes!!
Marie-2, Husband-1,
Daughter-1