Important Derivations of Physics, Class 12 - CBSE

Chapter 1 (Electric Charges and Fields)

1. Coulomb's law of Electric Force
2. Coulomb's law in vector form
3. Principle of superposition of electrostatic forces
4. Electric field (EF) due to a point charge
5. EF due to a system of point charges
6. EF at axial point of electric dipole
7. EF at equatorial point of electric dipole
8. Torque on a dipole in uniform EF
9. Gauss's theorem
10. EF due to a uniformly charged infinite plane sheet
11. EF of 2 positively charged parallel plates
12. EF due to 2 oppositely charged parallel plates
13. EF due to uniformly charged thin spherical shell
14. EF of a line charge (from Coulomb's law)
15. EF due to an infinitely long straight charged wire
16. Deduction of Coulomb's law from Gauss's theorem

Chapter 2 (Electrostatic Potential & Capacitance)

1. Electric Potential (EP) due to a point charge.
2. EP at an axial point of dipole
3. EP at an equatorial point of dipole
4. EP at any general point due to a dipole
5. EP due to a group of point charges
6. EP due to uniformly charged thin spherical shell
7. Relation between EF & EP
8. Potential Energy (PE) of system of 2 point charges
9. PE of a system of 3 point charges
10. PE of a system of N point charges
11. PE of a single charge
12. PE of system of 2 point charges in an external field
13. PE of a dipole placed in an uniform electric field
14. Parallel Plate Capacitor (Capacitance)
15. Capacitors in series & parallel
16. Energy stored in a capacitor
17. Energy stored in series combination of capacitors
18. Energy density of an EF
19. Reduced field inside a dielectric & dielectric constant
20. Electric susceptibility
21. Relation between electric susceptibility & dielectric constant
22. Capacitance of a parallel plate capacitor with a dielectric slab
23. Collecting action of a hollow sphere

Chapter 3 (Current Electricity)

1. Wheatstone Bridge (Working & Balanced condition)
2. Meter Bridge (Principle, Construction & Working)

Chapter 4 (Moving charges & Magnetism)

1. Biot-Savart's law (statement and derivation of formula)
2. Magnetic Field (MF) due to a long straight current carrying conductor

3. Potentiometer (Principle, Construction)
4. Applications of a potentiometer:
   - Comparison of emfs of 2 primary cells
   - Internal resistance of a primary cell
5. Resistances in series & parallel

6. Relation between potential difference (V), internal resistance (r) and emf (E)

7. Cells in series and parallel

8. Condition for max current from (series & parallel) combination of cells

9. Power consumed by (series & parallel) combination of appliances

10. Mobility of charge carriers

11. Relation between (b/w) electric current (I) and mobility for conductors

12. Relaxation time and drift velocity

13. Relation b/w (I) and drift velocity

14. Deduction of Ohm's law (from drift velocity)

15. Ohm's law in vector form

3. MF at center of circular current loop.
4. MF along axis of circular current loop
5. Ampere's circuital law (its proofs for straight current carrying conductor & straight conductor)
6. Calculation of MF inside a long straight solenoid
7. MF due to a toroidal solenoid
8. Moving coil galvanometer (MCG) (Principle, construction, theory and working)
9. Figure of merit and sensitivity (current & voltage) of a MCG
10. Conversion of MCG to Ammeter
11. Conversion of MCG to Voltmeter
12. Torque on current loop in uniform MF
13. Force between 2 parallel current carrying wires
14. Force on a current carrying conductor in MF
15. Cyclotron (Principle, construction, theory, working and expression for max KE of accelerated ions)
16. Work done by a magnetic force on a charged particle
17. Velocity selector

Chapter 5 (Magnetism & Matter)

1. MF of a bar magnet at an (axial & equatorial) point
2. Torque on magnetic dipole in a uniform MF
3. Potential energy of magnetic dipole
4. Current loop as magnetic dipole
5. Magnetic dipole moment of a revolving electron

Chapter 6 (Electromagnetic Induction)

1. Mutual Induction (its coefficient and emf in terms of coefficient and rate of change of current w.r.t time)
2. Mutual induction of 2 long solenoids
3. Self Induction (its coefficient and emf in terms of coefficient and rate of change of current w.r.t time)
4. Self inductance of a long solenoid
5. Different methods of generating emf (and the respective emf expressions)
6. Motional emf from Faraday's law :

	Induced emf by change of area of coil linked with MF 7. Motional emf from Lorentz force , Current induced in loop, power delivered by external force and power dissipated as Joule loss
Chapter 7 (Alternating Current) 1. A.C Generator (Principle, construction, working and expression for induced emf) 2. Transformer (Principle, construction, working and theory) 3. Mathematical treatment of LC oscillations 4. Conservation of energy in LC oscillations 5. Mechanical analogy for LC oscillations 6. Power in A.C circuit 7. Average power associated with (resistor, inductor and capacitor) 8. Series LCR circuit (phasor diagrams, expression for impedance , resonance condition) 9. Sharpness of resonance : Q-Factor 10. Expression for Q-Factor 11. AC circuit containing resistor only (and phasor diagram) 12. AC circuit containing inductor only (and phasor diagram), phase relation b/w emf and current, inductive reactance 13. AC circuit containing capacitor only (and phasor diagram), phase relation b/w emf and current, capacitive reactance 14. Average value of AC over 1 complete cycle 15. Relation b/w avg and peak values of AC 16. Relation b/w effective and peak values of AC 17. Relation b/w rms and peak values of alternating emf	**Chapter 8 (Electromagnetic Waves)** 1. Maxwell's modification of Ampere's law 2. Consistency of modified Ampere's law

Chapter 9 (Ray optics & optical instruments)

1. Cassegrain reflecting telescope (with diagram, magnification for final image formed at (infinity, least distance of distinct vision))
2. Astronomical telescope : When final image is formed at (infinity (normal adjustment), least distance of distinct vision) -working, diagrams and magnifying powers in each case
3. Compound microscope : When final image is formed at (infinity , least distance of distinct vision) - working, diagrams and magnifying powers in each case
4. Simple microscope : When final image is formed at (infinity , least distance of distinct vision) -working, diagrams and magnifying powers in each case
5. Formation of image by spherical lenses
6. Thin lens formula for a convex lens when it forms a (real & virtual) image
7. Thin lens formula for a concave lens
8. Linear magnification produced by a lens (in terms of u & f ; v & f)
9. Lens maker's formula for a double convex lens , double concave lens
10. Refraction at convex spherical surface
    - When object lies in rarer medium & image formed is real
    - When object lies in rarer medium & image formed is virtual
    - When object lies in denser medium & image formed is real
    - When object lies in denser medium & image formed is virtual
11. Refraction at concave spherical surface

Chapter 10 (Wave Optics)

1. Laws of reflection on basis of Huygen's wave theory
2. Laws of refraction on basis of Huygen's wave theory
3. Refraction at a rarer medium
4. Refraction of a plane wavefront through a prism, convex lens and a concave mirror
5. Expression for intensity at any point in interference pattern ; and the corresponding conditions for (constructive & destructive) interference
6. Expression for fringe width in Young's double slit experiment (YDSE) ; and formulae for positions of (bright & dark) fringes
7. Expression for ratio of intensities at maxima and minima in an interference pattern
8. Diffraction at a single slit - Central maximum, calculation of path difference, positions of minima, positions of secondary maxima, intensity distribution curve
9. (Angular & linear) width of central maximum, linear width of a secondary maximum
10. Fresnel's distance & Fresnel's zone
11. Resolving power of a microscope and telescope
12. Doppler effect - expression for apparent frequency of light, (blue & red) shifts

- When object lies in rarer medium
- When object lies in denser medium

12. Derivation of mirror formula for a concave mirror when it forms a (real & virtual) image

13. Derivation of mirror formula for a convex mirror

14. Linear magnification produced by mirrors (in terms of u & f ; v & f)

15. Refraction through a rectangular glass slab

16. ^^ and expression for lateral displacement

17, Equivalent focal length and power of 2 thin lenses in contact.

Chapter 11 (Dual nature of radiation and matter)

1. Determination of Planck's constant and work function from graph of stopping potential vs frequency of incident radiation for a photosensitive material
2.

Chapter 12 (Atoms)

1. Distance of closest approach in Rutherford's experiment, and the formula for radius of nucleus which is thus derived from it
2. Bohr's quantization condition of angular momentum
3. Bohr's theory of hydrogen atom - formulae for radii of permitted orbits, velocity of electrons in those orbits and energy of electron in those orbits
4. Spectral series of hydrogen atom

Chapter 13 (Nuclei)

1. Formula for nuclear density in terms of radius of a nucleus
2. Expression for binding energy
3. Radioactive decay law
4. Relation b/w half life & decay constant
5. Relation b/w mean life & decay constant
6. Decay rate / activity of a radioactive sample
7.

Chapter 14 (Semiconductor electronics)

1. Truth table, logic symbols and waveform examples for NOT, AND, OR, NAND and NOR gates
2. npn transistor as a common emitter (CE) amplifier ; (current,voltage and power) gains of a CE amplifier
3. Amplifier theory
4. Transistor as a switch - 3 states of a transistor (cutoff, active and saturation) , switching action of a transistor

	5. Actions of (npn & pnp) transistors 6. Current gains in a transistor (α & β) and the relation b/w them 7. CE characteristics (input & output and their theory) 8. Solar cell (construction, working, diagram, and V-I characteristic) 9. Light emitting diode (LED) - (construction, working, diagram, and I-V characteristic) 10. Photodiode (construction, working, diagrams and I-V characteristic) 11. Cause of reverse breakdown of a junction diode - (Zener & avalanche) breakdowns ; their causes in brief and V-I characteristics in both cases 12. Zener diode - construction, working, diagram 13. Zener diode as a voltage regulator - working, diagram and graph b/w (input & output) voltages 14. Junction diode as a (half-wave & full-wave) rectifier - working, diagrams and waveform graphs 15. Working of a p-n junction in both types of (forward & reverse) biasing - diagrams and brief theory 16. V-I characterisics of a p-n junction diode - forward-bias & reverse bias characteristic graphs and their brief theory 17. p-n junction - working in brief, diagram

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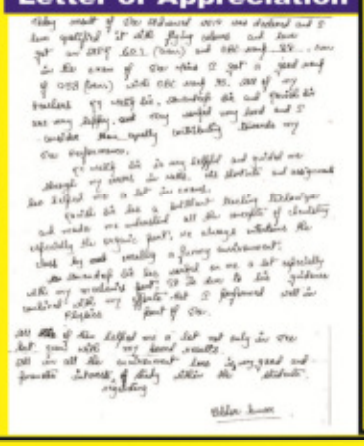

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13. J.A.C (XII), 2014 (Admitted by J.A.C)
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In a question
of JEE-Advanced 2014
and finally
winning through
decision of IIT
on 1st June, 2014.

[ns¹⁻²]

[(n-1)d¹⁻¹⁰ ns⁰⁻²]

[ns² np¹⁻⁵]

[ns² np⁶]

1 1A												2 IIA	13 IIIA	14 IV	15 VA	16 VIA	17 VIIA	18 INERT GASSES
1 1.008 G H HYDROGEN 1s¹																		2 4.022 G He HELIUM 1s²
3 6.941 S Li LITHIUM 2s¹												4 9.012 S Be BERYLLIUM 2s²	5 10.811 S B BORON 2s²2p¹	6 12.011 S C CARBON 2s²2p²	7 14.007 G N NITROGEN 2s²2p³	8 15.999 G O OXYGEN 2s²2p⁴	9 18.998 G F FLUORINE 2s²2p⁵	10 20.180 G Ne NEON 2s²2p⁶
11 22.989 S Na SODIUM 3s¹												12 24.305 S Mg MAGNESIUM 3s²	13 26.982 S Al ALUMINIUM 3s²3p¹	14 28.085 S Si SILICON 3s²3p²	15 30.974 S P PHOSPHORUS 3s²3p³	16 32.066 S S SULPHUR 3s²3p⁴	17 35.453 G Cl CHLORINE 3s²3p⁵	18 39.948 G Ar ARGON 3s²3p⁶
19 39.098 S K POTASSIUM 4s¹	20 40.078 S Ca CALCIUM 4s²	21 44.95 S Sc SCANDIUM 3d¹4s²	22 47.867 S Ti TITANIUM 3d²4s²	23 50.942 S V VANADIUM 3d³4s²	24 51.996 S Cr CHROMIUM 3d⁵4s¹	25 54.938 S Mn MANGANESE 3d⁵4s²	26 55.845 S Fe IRON 3d⁶4s²	27 58.933 S Co COBALT 3d⁷4s²	28 58.693 S Ni NICKEL 3d⁸4s²	29 63.546 S Cu COPPER 3d¹⁰4s¹	30 65.39 S Zn ZINC 3d¹⁰4s²	31 69.723 S Ga GALLIUM 4s²4p¹	32 72.61 S Ge GERMANIUM 4s²4p²	33 74.922 S As ARSENIC 4s²4p³	34 78.96 S Se SELENIUM 4s²4p⁴	35 79.904 L Br BROMINE 4s²4p⁵	36 83.8 G Kr KRYPTON 4s²4p⁶
37 85.468 S Rb RUBIDIUM 5s¹	38 87.62 S Sr STRONTIUM 5s²	39 88.906 S Y YTTRIUM 4d¹5s²	40 91.224 S Zr ZIRCONIUM 4d²5s²	41 92.906 S Nb NIOBIUM 4d⁴5s¹	42 95.94 S Mo MOLYBDENUM 4d⁵5s¹	43 (98.0) X Tc TECHNETIUM 4d⁵5s²	44 101.07 S Ru RUTHENIUM 4d⁷5s¹	45 102.905 S Rh RHODIUM 4d⁸5s¹	46 106.42 S Pd PALLADIUM 4d¹⁰	47 107.868 S Ag SILVER 4d¹⁰5s¹	48 112.411 S Cd CADMIUM 4d¹⁰5s²	49 114.818 S In INDIUM 5s²5p¹	50 118.71 S Sn TIN 5s²5p²	51 121.76 S Sb ANTIMONY 5s²5p³	52 127.6 S Te TELLURIUM 5s²5p⁴	53 126.905 S I IODINE 5s²5p⁵	54 131.29 G Xe XENON 5s²5p⁶
55 132.906 S Cs CESIUM 6s¹	56 137.327 S Ba BARIUM 6s²	57 138.906 ★ S La LANTHANUM 5d¹6s²	72 178.49 S Hf HAFNIUM 5d²6s²	73 180.948 S Ta TANTALUM 5d³6s²	74 183.84 S W TUNGSTEN 5d⁴6s²	75 186.207 S Re RHENIUM 5d⁵6s²	76 190.23 S Os OSMIUM 5d⁶6s²	77 192.217 S Ir IRIDIUM 5d⁷6s²	78 195.078 S Pt PLATINUM 5d⁹6s¹	79 196.967 S Au GOLD 5d¹⁰6s¹	80 200.59 L Hg MERCURY 5d¹⁰6s²	81 204.383 S Tl THALLIUM 6s²6p¹	82 207.2 S Pb LEAD 6s²6p²	83 208.98 S Bi BISMUTH 6s²6p³	84 (209) S Po POLONIUM 6s²6p⁴	85 210.0 S At ASTATINE 6s²6p⁵	86 222.0 G Rn RADON 6s²6p⁶
87 (223.0) S Fr FRANCIUM 7s¹	88 (226.0) S Ra RADIUM 7s²	89 (227.0) S Ac ◎ ACTINIUM 6d¹7s²	104 (261.0) X Rf RUTHERFORDIUM 6d²7s²	105 (262.0) X Db DUBNIUM 6d³7s²	106 (263.0) X Sg SEABORGIUM 6d⁴7s²	107 (262.0) X Bh BOHRIUM 6d⁵7s²	108 (265.0) X Hs HASSIUM 6d⁶7s²	109 (266.0) X Mt MEITNERIUM 6d⁷7s²	110 (271.0) X Ds DARMSTADTIUM 6d⁸7s²	111 (272.0) X Rg ROENTGENIUM 6d⁹7s²	112 (277.0) X Cn COPEMICIUM 6d¹⁰7s²	113 (277.0) X Uut UNUNTRIUM 7s²7p¹	114 (289.0) X Fl FLEROVIUM 7s²6p²	115 (288.0) X Uup UNUNPENTIUM 7s²6p³	116 (292.0) X Lv LIVERMORIUM 7s²7p⁴	117 X Uus UNUNSEPTIUM	118 X Uuo UNUNOCTIUM 7s²7p⁶
s		d											p					

f — [(n-2)f⁰⁻¹⁴ (n-1)d⁰⁻¹ ns²]

58 140.116 S Ce ☸ CERIUM 4f¹5d¹6s²	59 140.908 S Pr PRASEODYMIUM 4f³6s²	60 144.24 S Nd NEODYMIUM 4f⁴6s²	61 (145.0) X Pm PROMETHIUM 4f⁵6s²	62 150.36 S Sm SAMARIUM 4f⁶6s²	63 151.964 S Eu EUROPIUM 4f⁷6s²	64 157.25 S Gd GADOLINIUM 4f⁷5d¹6s²	65 158.93 S Tb TERBIUM 4f⁹6s²	66 162.5 S Dy DYSPROSIUM 4f¹⁰6s²	67 164.93 S Ho HOLMIUM 4f¹¹6s²	68 167.26 S Er ERBIUM 4f¹²6s²	69 168.934 S Tm THULIUM 4f¹³6s²	70 173.04 S Yb YTTERBIUM 4f¹⁴6s²	71 174.967 S Lu LUTETIUM 7f¹⁴5d¹6s²
90 232.038 S Th ☺ THORIUM 6d²7s²	91 231.036 S Pa PROTACTINIUM 5f²6d¹7s²	92 238.029 S U URANIUM 5f³6d¹7s²	93 (237.0) X Np NEPTUNIUM 5f⁴6d¹7s²	94 (244.0) S Pu PLUTONIUM 5f⁶7s²	95 (243.0) X Am AMERICIUM 5f⁷7s²	96 (247.0) X Cm CURIUM 5f⁷6d¹7s²	97 (247.0) X Bk BERKELIUM 5f⁹7s²	98 (251.0) X Cf CALIFFORNIUM 6f¹¹7s²	99 (252.0) X Es EINSTEINIUM 5f¹¹7s²	100 (257.0) X Fm FERMIUM 5f¹²7s²	101 258.0 X Md MENDELEVIUM 5f¹³7s²	102 (259.0) X No NOBELIUM 5f¹⁴7s²	103 (162.0) X Lr LAWRENCIUM 5f¹⁴6d¹7s²

G Gas — L Liquid — S Solid — X Not found in nature

★ LANTHANIDES [4f-series] [4f¹⁻¹⁴ 5d⁰⁻¹ 6s²]

◎ ACTINIDES [5f-series] [5f⁰⁻¹⁴ 6d⁰⁻¹ 7s²]

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आईआईटी के एक सवाल को गलत साबित किया

ranchi@inext.co.in

RANCHI (18 June): न्यूटन क्लासेस के डायरेक्टर आरके मल्लिक ने एक बार फिर आईआईटी एडवांस के मैथ्स के एक सवाल को गलत साबित किया. उन्होंने 24 मई की शाम को ही वेक्टर अल्जेबरा के एक सवाल को गलत बताया. आईआईटी ने भी जब 8 जून को अपना आंसर डिक्लेयर किया तो उस सवाल को सही बताया. आरके मल्लिक ने आईआईटी को पुन: उस सवाल पर ध्यान दिलाया तो 13 जून को आईआईटी ने अपनी गलती मानी और सभी कैंडिडेट्स को 4 अतिरिक्त मार्क्स देने की घोषणा की. आरके मल्लिक की सराहना करते हुए

बाबूलाल मरांडी ने आरके मल्लिक न्यूटन क्लासेस में आकर उन्हें सम्मानित किया. मल्लिक ने पिछले कई वर्षों से आईआईटी एग्जाम में गलती निकाली है.

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