Part-I [Physics]

1. State Gauss's law. Derive an expression for the electric field due to an infinite line charge and infinite sheet. [Deduce Coulomb's law from Gauss's law and electric field due to conducting sphere.]
2. Electric field due to a dipole.
3. Potential due to dipole on axial and equatorial line.
4. Electric field due to dipole general expression.
5. Derive an expression for capacitance, principle of capacitor, and expression for capacitance of parallel plate with or without dielectric.
6. Derive an expression for the torque experienced by dipole in uniform electric field?
7. Explain equipotential surfaces and their characteristics?
8. What is meant by quantization of charge?
9. What is an electric dipole and electric dipole moment?
10. State Coulomb's law, express in vector form, define unit charge.
11. Properties of electric lines of force and define electric flux, its units.
12. Work done in rotating a dipole in uniform electric field and its potential energy?
13. What is current, drift velocity, find relation between current and drift velocity?
14. Ohm's Law, VI curve, R = ρl/A, Temp. dependence of resistance, temp coefficient of resistance.
15. A wire of resistance R is stretched so that its length becomes double, what is new resistance?
16. EMF and potential difference.
17. State and explain Kirchhoff's rules and obtain balance condition for Wheatstone bridge.
18. Magnetic force acting on a charged particle, its circular path, and expression for radius and time period.
19. State Biot Savart law. Obtain expression for magnetic field due to circular coil (Straight conductor).
20. Torque on a current loop and construction and working of moving coil galvanometer. Define current sensitivity.
21. Torque on a current loop and construction and working of moving coil galvanometer. Define voltage sensitivity.
22. State Ampere's circuital law. Apply it on straight conductor and solenoid.
23. Difference between para, dia, and ferromagnetic materials (properties). Domain theory of ferromagnetism.
24. Construction and working of moving coil galvanometer? Also explain current sensitivity and voltage sensitivity.
25. Explain Ampere's circuital law? Also determine magnetic field because of:
    (i) Straight thin infinite current-carrying conductor.
    (ii) Thick infinite current-carrying conductor.
    (iii) Solenoid.
    (iv) Toroid.
26. **Magnetic Flux:**
    $\Phi B = B \cdot A$ .....(1)
    $\Phi B = |B|\,|A| \cos\theta$ .....(2)

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27. Factors on which flux depends:
    (a) Field crossing the loop.
    (b) Area of the loop.
    (c) Angle between n̂ and **B**.
28. SI unit:
    $\Phi = Tm^2$
    1 Weber = 1 Tm^2.
29. **Faraday's 1st Law:**
    When the magnetic flux linked to a closed loop (or closed circuit) changes, an EMF is induced in the loop, which lasts as long as the flux through the loop keeps on changing.
30. **Faraday's 2nd Law:**
    "The EMF induced in a closed loop is directly proportional to the rate at which the flux changes through the loop."
    $|\varepsilon| \propto |d\Phi/dt|$
    $\Rightarrow |\varepsilon| = |d\Phi/dt|$
    $\Rightarrow \varepsilon = -d\Phi/dt$
31. **Meaning of –ve sign:**

- Negative sign gives the sense of induced EMF in the loop.
- Its meaning is that the induced EMF opposes the change in flux through the loop.

32. **Lenz's Law:**
    Lenz's law gives the direction of induced EMF in a loop.
    According to this law:
    "The EMF induced in any loop due to change in flux through it has a direction which opposes the change that has produced it."
33. **Lenz's Law follows:**

- The law of conservation of energy.
- An external source has to work to change the flux through the loop and produce EMF or current in the loop.

34. **Derive mirror formula for a concave mirror.**
    Relation between position of object (u), position of image (v) & focal length (f) of the mirror.
    Sign Conventions:
    (i) All distances are measured from the pole.
    (ii) Distances measured in the direction of incident light are taken as positive & distances opposite to the direction of the light are taken as negative.
    (iii) Heights above P-axis taken as +ve & below P-axis are taken as –ve.
    $1/f = 1/u + 1/v$

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35. An object is placed in front of a concave mirror of focal length 10 cm at a distance of 30 cm. Find the position & nature of the image formed.
36. Derive lens maker's formula.
    Assumptions:

- Lens is thin & all distances are measured from the optical center.
- Aperture is small.
- Object is point-sized & placed on the P-axis.

37. What is real and apparent depth?
38. What is total internal reflection? Derive relation for the critical angle. Discuss any two applications.
39. **Mirage:** It is an optical illusion observed generally in deserts when an inverted image of an object is observed along with the object itself on a hot day.
40. **Optical Fiber:** A thin strand of plastic or glass used to transmit signals in the form of light over a long range and distances.
41. Prove for a prism (Prism Formula):
    $\mu = (\sin (A + \delta m)/2) / (\sin A/2)$
42. What is dispersion of light? Discuss its causes.
43. What is angular dispersion & dispersive power?
44. Power of a lens?
45. What is a compound microscope with the help of a labeled diagram? Show image formation. Derive expression for its magnifying power.
46. Explain the construction and working of an astronomical telescope. Derive the expression for magnifying power.
47. What is a wavefront, and what are its various types?
48. State Huygens Principle and explain the laws of reflection and refraction using Huygens principle.
49. Describe Young's double-slit experiment. How can we find the position of bright and dark bands? Write down the expression for fringe width.
50. What is diffraction of light? Explain diffraction due to a single slit. What is the width of the central maximum?
51. What are coherent sources of light? What are the conditions for sustained interference of light?
52. Discuss the photoelectric effect and Einstein's photoelectric equation.
53. Laws of photoelectric emission.
54. Define threshold frequency, wavelength, stopping potential, and the effect of frequency on stopping potential.
55. Discuss the matter-wave nature of particles and de-Broglie relation.
56. Postulates of Bohr's model and expression for radius and energy.
57. Binding energy and binding energy curve and its variation with mass number.
58. Define nuclear fission and nuclear fusion reactions.
59. Define nuclear force and its properties.
60. On the basis of band theory of solids, explain the difference between conductors, semiconductors, and insulators.
61. What is doping? Discuss extrinsic and intrinsic semiconductors.
62. Working of PN junction as a diode.
63. PN junction as a rectifier.
64. Displacement current in a capacitor.
65. Explain the electromagnetic spectru

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12th Zoology Important Guess Questions

1. Draw a well-labelled diagram of the male reproductive system and explain the male reproductive system.
2. Draw a well-labelled diagram of the female reproductive system.
3. Write a short note on Testis?
4. Write a short note on Ovaries?
5. Describe the steps of spermatogenesis and also differentiate between spermiogenesis and spermiation.
6. What is the menstrual cycle? Explain the ovarian and uterine changes that occur during a menstrual cycle in a human female under the influence of pituitary and ovarian hormones, respectively.
7. Explain the process of fertilization in humans?
8. Describe the gestation period and parturition. From where does the signal for parturition originate in humans?
9. Define the term lactation and colostrum. Why is it important to feed newborn babies in the initial period of their growth?
10. What are the consequences of delay in treatment of STIs? What principles should be followed to be free from sexually transmitted infections?

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11. Explain MTP and state its significance?
12. What is contraception? Discuss various methods of contraception?
13. Explain MTP and state its significance.
14. What are STDs? How are these diseases spread? Give examples of STDs.
15. What are contraceptives? List any four characteristics of ideal contraceptives.
16. Define infertility. State any two reasons responsible for the cause of infertility.
17. Explain IVF-ET?
18. Explain the process of Haplodiploidy sex determination in honey bees?
19. Discuss two Mendelian disorders: color blindness and hemophilia in detail.
20. Briefly explain the Mendelian disorder phenylketonuria.
21. Write a short note on causes and symptoms of sickle cell anemia.
22. Mention the chromosomal complement and characteristics of a person affected with Down's syndrome, Turner's syndrome, and Klinefelter's syndrome?
23. Define pedigree analysis. (a) Mention a few applications of pedigree analysis. (b) Show some of the important standard symbols used in pedigree analysis.

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24. Give an account of Urey and Miller's experiment and its significance.
25. Define Natural Selection & its types.
26. What is the Hardy-Weinberg principle?

(a) Write the mathematical expression of Hardy Weinberg principle
(b) What would you interpret if the value of 1 in the equation gets deviated?
(c) List the factors which affect genetic equilibrium of Hardy Weinberg population and briefly explain each

27. What is genetic drift? Briefly explain its types?
28. Trace out the process of evolution of man in detail?
29. What is adaptive radiation? Give an example?
30. What is Convergent Evolution? Give an example?
31. Differentiate between Homologous and Analogous organs? Briefly explain how these are considered as an evidence of evolution.
32. Describe the following diseases along with their causative agent, mode of transmission, symptoms and preventive measures?
    (a) Typhoid
    (b) Amoebiasis
    (c) Ascariasis
    (d) Filariasis

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33. Describe AIDS, how it is transmitted, its prevention and diagnostic tests used for its diagnosis
34. Write short note on malaria?
35. Describe cancer as a major cause of death along with its causes and possible treatment?
36. Differentiate between:
    (a) Innate immunity and acquired immunity
    (b) Active and passive immunity
37. Describe the structure of antibody
38. Briefly explain Lymphoid organs and their types
39. Explain briefly about:
    (a) Opioids
    (b) Cannabinoids
    (c) Coca alkaloids
40. What are restriction endonucleases and what are their uses?
41. Explain Gel electrophoresis and its uses.
42. What is PCR? Describe its steps along with their types.
43. What are bioreactors? Explain their types.
44. What do you mean by Golden Rice?
45. What is Gene Therapy? Give one example.
46. Write down the steps of preparation of Human Insulin artificially.

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12th Botany Important Guess Questions

Reproduction in Flowering Plants

1. Explain the development of pollen grain in angiosperms.
2. Describe the structure and development of female gametophyte.
3. What is double fertilisation?
4. Explain the following terms:
   (a) Apomixis
   (b) Endosperm

Genetics

1. Give a detailed account of the Law of Independent Assortment.
2. Define the following:
   (a) Co-dominance
   (b) Multiple allelism
   (c) Polygenes inheritance

1. What is pleiotropism?
2. Give the detailed account of DNA replication with emphasis on the semi-conservative mode.
3. Explain the functioning of Lac Operon in detail.
4. Define the following:
   (a) Genetic code

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(b) Transcription unit
(c) Central Dogma

Ecology and Environment

1. Give a brief account of the following population interactions:
   (a) Parasitism
   (b) Mutualism
2. Explain the process of decomposition in detail.
3. Give a detailed account of the ecological pyramids.
4. How is exponential growth different from logistic growth?
5. Define:
   (a) Food chain
   (b) Productivity
6. Explain the patterns of biodiversity with emphasis on species-area relationships.
7. What are the main causes of biodiversity loss?

Biology and Human Welfare

1. Explain the role of microbes in household.
2. What is organic farming, and how is it beneficial?
3. Write short notes on:
   (a) Sewage treatment plant
   (b) Antibiotics

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12th Chemistry Important Guess Questions

1. Define the following terms:
   (i) Molarity (M)
   (ii) Normality (N)
   (iii) Molality (m)
   (iv) Mole fraction (x)
2. Define Raoult's law for volatile and non-volatile solute.
3. Differentiate between ideal and non-ideal solution.
4. What are colligative properties?
   (i) What is elevation in boiling point, and how is molecular mass of a non-volatile solute determined from it?
   (ii) What is osmotic pressure, and how is molecular mass of a non-volatile solute determined from it?
5. What are azeotropes or azeotropic mixtures?
6. What is abnormal molecular mass? Van't Hoff factor.
7. Define conductance (G), conductivity (K), and molar conductivity (Λm).
8. Kohlrausch's law and its applications.
9. Galvanic cell (working and construction).
10. Nernst equation.
11. Faraday's laws of electrolysis.
12. Corrosion - an electrochemical phenomenon. Explain.
13. Define rate of reaction:
    (i) What are the types of rate of reaction?
    (ii) What are the units of rate of reaction?
14. What are the factors that affect the rate of reaction?
15. Difference between order and molecularity of a reaction.
16. Write the units of rate constant of zero, first, and second-order reactions.
17. Derive the integrated rate expression of zero and first-order reactions and write their half-lives.
18. What is the effect of temperature on the rate of reaction?
19. Derive Arrhenius equation.
20. Explain Finkelstein and Swarts reactions.

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21. SN1S_N1 and SN2S_N2 reaction mechanisms.
22. Why haloarenes do not show SN1S_N1 and SN2S_N2 mechanisms?
23. Discuss electrophilic substitution reactions of haloarenes.
24. Explain the following:
    (i) Wurtz reaction
    (ii) Fittig reaction
    (iii) Wurtz-Fittig reaction
25. Uses of DDT, Chloroform, and Iodoform.
26. Preparation of Phenols:
    (i) From Arene diazonium salts
    (ii) From Chloroarenes (Dow's Process)
27. Write short notes on:
    (i) Kolbe's reaction
    (ii) Reimer-Tiemann reaction
28. Why are phenols more acidic than alcohols?
29. Discuss nitration and bromination of phenol.
30. Explain Williamson's synthesis.
31. How can you differentiate primary, secondary, and tertiary alcohols?
32. Define esterification.
33. Discuss the mechanism of dehydration of alcohols.
34. Electronic configuration of first transition series and transition elements.
35. Preparation and oxidizing character of KMnO4KMnO_4.
36. Lanthanoid contraction and its consequences.
37. Paramagnetism and colored nature in compounds of transition elements. Explain.
38. Preparation of aldehydes and ketones by:
    (i) Oxidation of alcohols
    (ii) Ozonolysis of alkenes
39. Illustrate the following reactions with examples:
    (i) Wolff–Kishner reduction
    (ii) Aldol condensation
    (iii) Clemmensen's reduction
    (iv) Cannizzaro's reaction
40. Hell–Volhard–Zelinsky reaction (HVZ Reaction).

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41. How can you differentiate aldehydes and ketones?
42. Give preparations of carboxylic acids.
43. Give three preparations of amines.
44. Discuss basic properties of primary, secondary, and tertiary amines in aqueous medium.
45. How can you differentiate between primary, secondary, and tertiary amines (Hinsberg Test)?
46. Classification of amines.

47. Explain the following:
    (i) Hoffmann Bromamide Degradation Reaction.
    (ii) Gabriel Phthalimide Synthesis.
    (iii) Carbylamine Reaction
48. What is Diazotization?
49. Properties of Diazonium salts:
50. Discuss electrophilic substitutions reactions of aniline:
    (i) Bromination
    (ii) Nitration
51. Ligands and classification of ligands.
52. Nomenclature of coordination compounds:
53. Werner's theory:
54. Isomerism in coordination compounds:
    (i) Linkage isomerism
    (ii) Ionization isomerism
    (iii) Hydration isomerism
55. Cyclic structure of glucose (Haworth structures)
56. Define briefly:
    (i) Maltose
    (ii) Lactose
    (iii) Sucrose
57. Proteins (Structure) and Amino acids
58. What are Vitamins and how they are classified?
59. What is the difference between DNA and RNA?
60. Give three chemical properties of Glucose

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