INTEL
BRIDGE COURSE
2025

A-Level Bridge Course

Course of Study

INTEL INSTITUTE
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A-Level Bridge Course

COURSE OF STUDY

Contents

PHYSICS

SECTION I: GENERAL PHYSICS

1. Physical Quantities and Units

- Physical quantities
- SI Units

2. Measurement Techniques

- Measurements
- Errors and uncertainties

3. Types of Physical Quantities

- Scalars and vectors

SECTION II: NEWTONIAN MECHANICS

4. Dynamics

- Newton's laws of motion
- Linear momentum and its conservation

5. Kinematics

- Linear motion
- Non-linear motion

6. Forces

- Types of force
- Equilibrium of forces
- Centre of gravity
- Turning effects of forces

7. Work, Energy & Power

- Energy conversion and conservation
- Work
- Potential energy, kinetic energy and internal energy
- Power

SECTION III: MATTER

8. Phases of Matter

- Density
- Solids, liquids, gases
- Pressure in fluids
- Change of phase

9. Deformation of Solids

- Stress, strain
- Elastic and plastic behaviour

SECTION IV: OSCILLATIONS AND WAVES

10. Waves

- Progressive waves
- Transverse and longitudinal waves
- Determination of speed, frequency and wavelength
- Electromagnetic spectrum
- Stationary waves

SECTION V: ELECTRICITY AND MAGNETISM

11. Electric Fields

- Concept of an electric field
- Uniform electric fields
- Force between point charges
- Electric field of a point charge
- Electric potential

12. Current of Electricity

- Electric current
- Potential difference
- Resistance and resistivity
- Sources of electromotive force

13. D.C. Circuits

- Practical circuits
- Conservation of charge and energy
- Balanced potentials

SECTION VI: MODERN PHYSICS

14. Nuclear Physics

- The nucleus
- Isotopes
- Nuclear processes
- Mass excess and nuclear binding energy
- Radioactive decay

CHEMISTRY

A: PHYSICAL CHEMISTRY

1. Atoms, Molecules and Stoichiometry

- Relative masses of atoms and molecules
- The mole, the Avogadro constant

2. Atomic Structure

- The nucleus of the atom: Neutrons and numbers
- Electrons: Electronic energy levels, ionisation energies, atomic orbitals, extranuclear

3. Chemical Bonding

- Ionic (electrovalent) bonding
- Covalent bonding and co-ordinate (dative covalent) bonding
- Bond energies, bond lengths and bond polarities
- Intermolecular forces, including hydrogen bonding
- Metallic bonding

4. States of Matter

- The gaseous state: pV = nRT and its use in determining a value for Mr
- The liquid state
- The solid state

5. Chemical Energetics

- Enthalpy changes: ΔH of formation, combustion, hydration, solution, neutralisation and electron affinity
- Hess' Law

6. Equilibria

- Chemical equilibria: reversible reactions; dynamic equilibrium
  - Equilibrium constants
  - The Haber process; the Contact process
- Ionic equilibria
  - Bronsted-Lowry theory of acids and bases
  - Acid dissociation constants, Ka and the use of pKa
  - The ionic product of water, Kw

7. Reaction Kinetics

- Simple rate equations; orders of reaction; rate constants
- Effect of temperature on rate constants; the concept of activation energy

B: INORGANIC CHEMISTRY

8. The Periodic Table: Chemical Periodicity

- Periodicity of physical properties of the elements: variation with proton number across the third period (sodium to argon) of:
  - Atomic radius and ionic radius
  - Melting point
  - Electrical conductivity
  - Ionisation energy
- Periodicity of chemical properties of the elements in the third period
  - Acid/base behaviour of these oxides and the corresponding hydroxides.
- Group II
  - Similarities and trends in the properties of the Group II metals magnesium to barium and their compounds
  - Some uses of Group II compounds

C: ORGANIC CHEMISTRY

9. Introductory Topics

- Molecular, structural and empirical formulae
- Functional groups and the naming of organic compounds
- Characteristic organic reactions
- HYDROCARBONS
  - Alkanes (exemplified by ethane): (i) Free-radical reactions and (ii) Crude oil and 'cracking'
  - II. Alkenes (exemplified by ethane: (i) Addition and oxidation reactions, (ii) Industrial importance
  - Hydrocarbons as fuels

10. Halogen Derivatives

- Halogenoalkanes and halogenoarenes
  - Nucleophilic substitution
  - Hydrolysis
  - Formation of nitriles, primary amines
  - Elimination
- Relative strength of the C-Hal bond

BIOLOGY

1. Introduction to Biology

- Nature & scope of Biology
- Various Branches of Biology
- Features common to living beings

2. Diversity of life

General concept of taxonomy, Binomial nomenclature, Hierarchic system of classification, two and five kingdom classifications, five kingdoms of life: Monera, Protista, Mycota, Plantae, Animalia

3. Biomolecules

General introduction of carbohydrates, proteins & lipids

4. Enzymes

Enzymes: General concept, mode of action

5. Nutrition

- Plant nutrition: Photosynthesis
- Animal nutrition: Different modes of nutrition
- Human alimentary canal, Physiology of digestion (Food and feeding mechanism, digestion, absorption, assimilation and egestion)

6. Transport

- Transport in plants
- Transport in humans

7. Respiration

- Aerobic respiration
- Anaerobic respiration
- Human gas exchange

8. Excretion and osmoregulation

- General idea

9. Control & co-ordination

- Nervous System: General idea
- Reflex action
- Hormones: General idea

10. Support, Movement & Locomotion

- Bones
- Joints

11. Health & disease

- Immunity
- Vaccination
- Antibiotics

12. Ecology

- Concept of Ecosystem
- Food chain
- Trophic level
- Ecological Pyramids

13. Genetics

- Structure of DNA
- Type of RNA
- Sex-linkage

14. Application of Biology

Genetic engineering

15. Wildlife conservation

General idea

16. Reproduction

- Gametogencsis
- Sporogenesis

MATHEMATICS

1. FUNCTION:

- Understand the terms function, domain, range, one-one function, inverse function and composite function.
- Identify the domain and range of a given function in simple cases and find the composition of two given functions.
- Sketch the graph of function of the form $f(x) = x^n$
- Illustrate in graphical terms the relation between a one-one function and its inverse.

2. QUADRATICS:

- Carry out the process of completing the sequence for a quadratic polynomial $ax^2 + bx + c$ and use it to sketch the graph of $ax^2 + bx + c$, find maximum & minimum values.
- Know the conditions for $f(x) = 0$ to have (i) two real roots (ii) two equal roots (iii) no real roots and use discriminant.

3. CIRCULAR MEASURE:

- Understand the definition of a radian and use the relationship between radians and degrees.
- Use the formulae $s = \frac{1}{2} r^2 \theta$ in solving the problems concerning the arc length and sector area, segment area of a circle.

4. TRIGONOMETRY:

- Sketch and use graphs of sine, cosine and tangent functions (for angles of any size, and using either degrees or radians).
- Find all the solutions of simple trigonometrical equations lying in a specified interval (general forms of solution are not included).

5. DIFFERENTIATION:

- Understand the idea of the gradient of a curve and use the notations $f'(x)$, $f''(x)$, $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$. (the technique of differentiation from first principles not required)
- Use the derivatives of the standard functions x^n(for only rational n) together with constant multiples, sums, differences of functions, and of composite functions, and of composite functions using the chain rule.
- Apply differentiation to gradients tangents and normals, increasing and decreasing functions.

6. Series:

- Use the expansion of $(a+b)^n$ where n is a positive integer (knowledge of the greatest term and properties of the coefficients are not required, but the notations $\binom{n}{r}$ and n! should be known)

- Recognize arithmetic and geometric progressions
- Use the formula for the nth term and for the sum of the first n terms.
- Use the condition for the Convergent of G.P. and the formula for me the Sum to infinity of a convergent G.P.

7. PERMUTATIONS AND COMBINATIONS:

- Understand the terms permutation and combination and solve simple problems involving selections.
- Solve problems about arrangements of objects in a line, including those involving repetition, restriction

8. PROBABILITY:

- Evaluate probabilities in simple cases by means of enumeration of equiprobable elementary events (e.g. for the total score when two fair dice are thrown) or by calculation using permutations or combinations
- Use addition and multiplication of probabilities, as appropriate, in simple cases. i.e. situation that can be represented by means of a tree diagram.

9. KINEMATICS OF MOTION IN A STRAIGHT LINE:

- Understand the concepts quantities, and of displacement , velocity and acceleration as vector quantities (in one dimension only)
- Sketch and interpret displacement time graphs and velocity-time graphs, and in Particular appreciate that the area under a velocity time graph represents displacement.

  The gradient of a displacement time graph represents velocity.
- The gradient if a velocity time graph represents acceleration.
- Use appropriate formula for motion with constant acceleration in straight line.

10. FORCES AND EQUILIBRIUM:

- Identify the forces acting in a given situation.
- Understand the vector nature of force, and find and use components and resultants.
- Use the principle that when a particle is in equilibrium, the vector sum of the forces acting is zero, or equivalently that the sum of the components in any direction is zero.
- Understand that a contact force between two surfaces can be represented by two components, the normal component and the frictional component.
- Understand the concepts of limiting friction and limiting equilibrium; recall the definition of coefficient of friction, and use the relationship.
- $F=\mu R$ or $F<\mu R$, as appropriate.

ENGLISH

1. Analogy
2. Synonyms
3. Antonyms
4. Single Words Substitution
5. Phrases and Idioms
6. Adverbs and Adjectives
7. Modal Auxiliaries
8. Countable and Uncountable nouns
9. Verbs
10. Causative and State Verbs
11. Tense
12. Speech - Direct and Indirect
13. Voice - Active and Passive
14. Questions
    - Indirect Questions
    - Information Question
    - Tag Questions
15. Subject - Verbs Agreement
16. Conditional Sentences
17. Conjunctions
    - Use of so & such
    - Therefore, Though, Until etc.
18. Preposition and Prepositional Phrases
19. Articles – A, An, The
20. Use of Some, Man, Any, Enough, A lot etc.
21. Suggestions, Offers and Invitations
22. Transformation of Sentences
23. Reading Comprehension
24. Writing
    - Paragraph Writing
    - Essay Writing
    - Precise Writing
    - Story Writing
    - Letter Writing