

## **Syllabus for Science Entrance Test**

### **Chemistry**

1. Atoms and Molecules. Atomic structure.
2. Elements, compounds and mixtures. Differences between elements, compounds and mixtures. Differences between metals and non-metals.
3. Acid and alkali. Characteristic properties of acids and bases. Basicity. Relative acidity and alkalinity in terms of pH.
4. Types of oxides. Classify oxides as either acidic, basic, or amphoteric related to metallic/non-metallic character.
5. Preparation, separation and purification of salts by the use of a suitable solvent, filtration, crystallisation and distillation.
6. Metals. General physical properties of metals. Alloys. Order of reactivity of calcium, copper, (hydrogen), iron, magnesium, potassium, sodium and zinc (with reference to reactions with water, steam and dilute HCl only). Apparent unreactivity of aluminium.
7. Uses of metals such as mild steel, stainless steel, aluminium, zinc and copper.
8. Combustion and rusting. Methods of rust prevention.

### **Mechanics**

9. S.I. base units and derived units. Prefixes: micro ( $\mu$ ), milli (m), centi (c), deci (d), kilo (k), and mega (M).
10. Mass, weight and centre of mass. Inertia. Experimental determination of the position of the centre of mass of a plane lamina. Stability of simple objects.
11. Densities of gases, liquids and solids. Simple calculations involving density.
12. Speed, velocity and acceleration. Motion for which the acceleration is constant. Speed-time graph. Acceleration of free fall.
13. Force. Effects of force. Extension-load graphs. Relation between force, mass and acceleration. Effect of friction on the motion of a body. Principle of moments.
14. Energy, work and power. Principle of conservation of energy. Efficiency. Kinetic energy and potential energy. Work done by and against a constant force (including friction).

15. Define pressure as force/area. Units of pressure;  $N\ m^{-2}$ , Pa, bar. Pressure due to a liquid column  $p = h \rho g$ . Barometer. Manometer.

### Heat

16. Qualitative treatment of the thermal expansion of solids, liquids and gases. Everyday applications and consequences of thermal expansion (including the expansion of water).
17. Temperature and its measurement. Liquid-in-glass thermometer. Thermocouple thermometer. Sensitivity and range. Fixed points. Celsius and Kelvin Scales.
18. Heat capacity and specific heat capacity. Calculations of heat gained and heat lost involving a change in temperature for solids and liquids.
19. States of matter. Properties of solids, liquids and gases. Brownian motion. Boyles' Law. Melting/solidification and boiling/condensation. Melting point and boiling point. Evaporation. Cooling by evaporation. Latent heat and specific latent heat. Calculations of heat gain and heat lost involving latent heat of fusion and vaporisation.
20. Conduction, convection and radiation. Good and bad conductors of heat. Simple molecular account of heat transfer in solids. Convection in fluids and density changes. Characteristics of good and bad emitters/absorbers of infra-red radiation. Everyday applications and consequences of conduction, convection and radiation.

### Waves

21. Properties of waves. Wave motion in vibrating ropes and springs and in a ripple tank. Transverse and longitudinal waves. The wave equation  $c = f \lambda$ . The main components of the electromagnetic spectrum.
22. Light. Reflection of light and the laws of reflection. Plane mirror. Refraction and the laws of refraction. The passage of light through parallel-sided transparent material. Refractive index.
23. Sound. The production of sound by vibrating sources. Compression and rarefaction. The approximate range of audible frequencies. Echoes.

### Magnetism

24. Nature of magnetism. Magnetic and nonmagnetic materials. Methods of magnetisation and demagnetisation. The properties of magnets. Magnetic fields. Magnetic properties of iron and steel. Induced magnetism. Uses of permanent magnets.

## **Electricity**

25. Insulators and conductors. Electric charge, current, electromotive force, potential difference, resistance, electrical energy and power. Ohm's Law. IV characteristic graphs for metallic (ohmic) and non-ohmic conductors.
26. Use of ammeter and voltmeter. Simple circuit diagrams containing sources, switches, resistors (fixed and variable), ammeters, voltmeters. Simple circuits with resistors in series and parallel.
27. Uses of electricity in heating and lighting. The cost of using electrical energy. Electrical safety. Fuses and fuse ratings. Earthing and double insulation. Meaning of the terms : live, neutral and earth.

## **Electromagnetism**

28. Qualitative treatment of the magnetic effects of current in straight and circular conductors and solenoids. The right-hand screw and grip rules.
29. Uses of electromagnets.
30. Force on a current-carrying conductor in a magnetic field. Fleming's left-hand rule. Forces between currents. Moving-coil instruments. Moving-coil loudspeaker. Direct-current motors. Force on a charged particle.
31. Qualitative treatment of electromagnetic induction. Faraday's law and Lenz's law.
32. Simple form of alternating-current generators (alternators).
33. Basic iron-cored transformer as used for voltage transformation (including the equations  $(V_p/V_s) = (N_p/N_s)$  and  $V_p I_p = V_s I_s$  for an ideal transformer).

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