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# A Level

## Physics

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## PHYSICS

The syllabus for the G.C.E. (Advanced Level) and the H.S.C. (Principal Subject) is printed in ordinary type. **It must be taken to include the syllabus for the subject Physics in Subject Syllabus S.** The additional matter printed in italics applies to the

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* The Special Papers which will be set in Physics, Chemistry, Botany, Zoology and Biology will be similar in character to the Scholarship papers which have previously been set in these subjects.

Special Papers only; but these papers may also include harder questions on the subject-matter printed in ordinary type.

At Advanced Level (H.S.C. Principal Subject), papers will be set as follows:

(*a*) Paper I — Section A: General Physics, four questions.
Section B: Heat, four questions; Sound, one question.

(*b*) Paper II — Section A: Light, three questions.
Section B: Magnetism and Electricity, six questions.

In Papers I and II, each of 2½ hr., candidates will be required to answer five questions, including at least one question from Section A and one question from Section B.

(*c*) Practical examination. Candidates will be required to answer question one and one of the two remaining questions. The examiners will not be strictly bound by the syllabus in setting an experiment. Where necessary, candidates will be told exactly what to do, only knowledge of theory within the syllabus being demanded. Candidates will be expected to understand the order of accuracy of their measurements and results. They may be asked to display their results, where possible, in the form of a graph which can be used for the extraction of further information.

The Special Paper (G.C.E. only) will be a 2½ hr. written paper containing harder questions and candidates will be required to answer any five out of nine questions.

## DETAILED PHYSICS SYLLABUS

### PAPER I

[Some students taking physics have a good knowledge of mathematics, for example elementary calculus, while others, whose main interest lies on the biological side, have little mathematical equipment. This latter group will necessarily be at a disadvantage in any examination in physics, but question papers will be set in such a way that non-mathematical students with a good understanding of physical principles have a reasonable choice of questions which they can answer. (Attention is called to Section 2B of the syllabus which is alternative to Section 2A.) On the other hand it is assumed that candidates





will not expect to take the Special Paper in physics unless they are also well equipped in mathematics.]

1. Dynamics of a particle moving in a straight line. Newton's laws of motion.

[Including the use of space-time and velocity-time graphs.]

*General law of gravitation. Definition of G. One laboratory method of determining G. Simple problems involving the use of G.*

2A.* Vector and scalar quantities; composition and resolution in one plane of velocities, accelerations, momenta and forces. Coefficient of restitution. Equilibrium of a rigid body under coplanar forces. Centre of gravity.

[Including experimental determination of coefficients of restitution.]

2B.* Simple phenomena of viscosity, including a determination of the coefficient for liquids; osmosis and the determination of osmotic pressure; Van't Hoff's law. Simple phenomena and determination of surface tension. Qualitative phenomena of diffusion.

[Proof of Poiseuille's equation is not required.]

3. *Stable and unstable equilibrium treated mathematically.*

[*Effect of position of centre of gravity of balance beam on the stability of a balance is included.*]

4. Static and kinetic friction.

[Experimental determination of the coefficient of kinetic friction is not required.]

5. Uniform motion in a circle.

6. Simple harmonic motion.

[Including its application to the simple pendulum, and the vibration of a mass at the end of a spring.]

*Other examples of simple harmonic motion.*

7. *Elementary treatment of the rotation of a rigid body about any axis, leading to the concept of moment of inertia. Experimental determination of moment of inertia about any axis through the centre of gravity, including flywheel and method of torsional oscillations.*

[*Parallel axis theorem and compound pendulum are excluded.*]

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* Whenever questions going beyond the requirements of the Ordinary level syllabus are set in Paper I on topics in paragraph 2A, alternative questions, which may include features of a descriptive and experimental character, will be set on the topics in paragraph 2B.

8. Pressure and thrust in fluids at rest.

Metacentre and centre of pressure not included.]

9. Simple phenomena of elasticity. Hooke's law, Young's modulus and its determination, elastic limit, yield point, work done in stretching.

10. Simple phenomena of viscosity and determination of coefficient for liquids, *turbulence and stream-line flow, including critical velocity.*

[Proof of Poiseuille's equation is not required.]

11. Simple phenomena of surface tension, excess pressure in spherical bubbles and drops, determination of the coefficient of surface tension by simple methods.

12. *Method of dimensions.*

[*Applied to such problems as rate of flow of viscous liquid through a tube and the oscillations of a drop.*]

13. Meaning of scale of temperature. Thermometry, including electrical methods. *The connexion between gas scale and other scales of temperature.*

[Apart from the verification of the fixed points, the corrections of a mercury in glass thermometer are not expected, nor is a detailed treatment of the platinum resistance thermometer and its circuit.]

14. Calorimetry, including continuous flow and cooling methods.

15. Relation between heat and work treated historically.

[One accurate mechanical and one accurate electrical method only are expected.]

16. Gas laws, Dalton's law of partial pressures.

17. Deduction of the gas laws from kinetic theory.

18. Deviations from simple gas laws *and their explanations.* Liquefaction of gases.

[Van der Waals' equation is excluded.]

19. The distinction between Cp and Cv. *Calculation of (Cp–Cv) for an ideal gas.*

20. Isothermal and adiabatic changes. *Equation of the adiabatic for an ideal gas.*

[*Including calculations of the work done in expansion and compression, and on temperature changes in adiabatic expansion and compression.*]





21. Thermal conductivity of solids of high *and low* conductivity by simple methods.

[One simple method *for each* will be expected.]

22. Newton's law of cooling.

23. Prevost's theory of exchanges. Stefan's law.

24. General characteristics of wave motion. The nature of sound.

[The equation for progressive waves is not required.]

25. Determination of the velocity of sound in free air.

26. Conditions affecting the transmission of sound in the atmosphere and in other media.

[The derivation of the formula for the velocity of sound is not required.]

27. Measurements of frequency. Beats, intensity and loudness. Quality of sounds. Laws of vibration of stretched strings.

[Including overtones of strings, and open and closed pipes. Derivation of the laws of vibrations of strings is not required.]

28. Stationary waves. Kundt's tube.

29. *Doppler effect and its application to sound and light.*

## PAPER II

30. Reflexion at spherical surfaces. Parabolic mirror.

31. Relation between critical angle and refractive index.

32. Refraction through a prism. Minimum deviation formula. Deviation by a prism of small angle.

33. Elementary formulae for thin lenses. Power of a lens. *Full formula for thin lens and its derivation.* Combination of thin lenses in contact.

[*Questions on refraction at single spherical surfaces will not be set.* No questions will be set involving any particular sign convention.]

34. Calculation of focal lengths of spectacle lenses to correct long sight or short sight.

35. Terrestrial telescope, Galilean telescope, reflecting telescope. Spectrometer and *adjustments of the spectrometer*, projection lantern.

[Including simple calculations on telescopes and microscopes.]

36. Methods of detection and properties of ultra-violet and infra-red radiation.

37. Simple qualitative discussion of (*a*) spherical aberration, and (*b*) chromatic aberration and its correction. *Quantitative treatment for two thin lenses in contact.*

38. Luminous intensity, candle power, illumination of a surface, foot-candle. Inverse square law and cosine law. *Luminous flux, lumen, lux.* A modern type of visual photometer. Application of the photo-electric cell to the measurement of light intensities.

39. Velocity of light and its determination by terrestrial methods.

40. Wave theory of light. Huygens' principle applied to the explanation of reflexion and refraction at a plane surface.

41. Conditions necessary for interference. Measurement of wave-length by an interference method, *including the diffraction grating. Newton's rings.*

42. A simple and qualitative treatment of the production and detection of plane polarized light.

*43. Magnetometry. Verification of inverse square law by one experimental method. Determination of the horizontal intensity of the earth's magnetic field. Determination of dip.

[Including vibration magnetometer; *proof of formula is intended for scholarship candidates only.*]

44. *Intensity of magnetization; I–H curves, hysteresis.*

[*Discussion of I–H curves to be qualitative only.*]

45. Elementary electrostatics, the inverse square law, definition of unit charge, electric potential, electric intensity, potential gradient. Capacitance of an isolated sphere. Influence of dielectric on capacitance.

[Verification of the inverse square law is not required. Questions will not be asked on Gauss' theorem, the mechanical force on the surface of a charged conductor, the attracted disc electrometer, the quadrant electrometer or the working of the Wimshurst machine.]

46. The Farad. Condensers in series and in parallel. Energy of a charged conductor. *Capacitances of two concentric spheres, two parallel plates.*

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* For an alternative syllabus in Magnetism and Electricity based on the M.K.S. system of units, see p. 10.





47. Magnetic field at the centre of a circular coil, its dependence upon the radius and number of turns. The electro-magnetic unit of current, ampere, coulomb; tangent galvanometer.

[Questions will not be asked on the fields at points other than at the centre of the coil.]

48. *Deduction of the magnetic field on the axis of an endless solenoid.*

49. The electro-magnetic unit of P.D., the volt, the temperature coefficient of resistance. *Kirchhoff's laws.*

[*Including calculations based on the application of Kirchhoff's laws to simple circuits.*]

50. *The force acting on a straight wire carrying a current in a uniform magnetic field; the application of this to the theory of the moving-coil galvanometer (rectangular coil only). Ballistic use of a galvanometer.*

[*The proof of the formula for the ballistic galvanometer is not required.*]

51. The Wheatstone bridge circuit. The use of the potentiometer for measuring P.D., current and resistance, including the internal resistance of a cell. Measurement of high resistances by substitution.

52. Electrolysis, including simple ionic theory.

[Questions will not be asked on ionic mobilities, contact potentials or on the construction of a standard cell.]

53. Thermo-couples and application to thermometry. Measurement of thermo-electric E.M.F.

[Questions will not be asked on thermo-electric power, the Peltier or the Thomson effect.]

54. The laws of induced E.M.F.'s and simple quantitative application. Mutual and self-inductance treated qualitatively, eddy currents.

55. The principles of A.C. and D.C. generators. The D.C. motor; the back E.M.F. of a motor. *Simple calculations on generators and motors.*

56. Instruments for measuring alternating current and voltage. R.M.S. values of current and P.D. Effects of capacitance and inductance in an A.C. circuit treated qualitatively, lag and lead.

[Calculations will not be set on A.C. in circuits containing inductance and capacitance.]