

都立国際高校 年間授業計画／Tokyo Metropolitan Kokusai High School Course Syllabus

○ 科目基礎情報 (Course information)

開講年度 (Academic year)	令和7年度 (2025 年度)
開講学科 (Department)	国際学科国際バカロレアコース／IBDP(International Baccalaureate Diploma Programme)
教科 (Subject Area)	Science
科目 (Subject)	Physics HL
学年・クラス (Grade・Class)	2nd Grade
単位数 (Number of units)	6
使用教科書 (Text Books)	Physics for the IB Diploma Programme 3rd Edition (by John Allum & Paul Morris)
校外学習 (Field trip)	None

○ 教科の目標 (Goals of the subject area)

【知識及び技能】 (Knowledge and Skills) <ul style="list-style-type: none"> acquire a body of knowledge, methods and techniques that characterize science and technology develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge. 【思考力、判断力、表現力等】 (Ability to think, make judgements, express themselves) <ul style="list-style-type: none"> apply and use a body of knowledge, methods and techniques that characterize science and technology develop an ability to analyse, evaluate and synthesize scientific information develop experimental and investigative scientific skills including the use of current technologies 【学びに向かう力、人間性等】 (Motivation to learn, Humanity) <ul style="list-style-type: none"> appreciate scientific study and creativity within a global context through stimulating and challenging opportunities develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities

○ 科目の目標 (Goals of the subject)

【知識及び技能】 (Knowledge and Skills)	【思考力、判断力、表現力等】 (Ability to think, make judgements, express themselves)	【学びに向かう力、人間性等】 (Motivation to learn, Humanity)
Demonstrate knowledge and understanding of: a. facts, concepts and terminology b. methodologies and techniques c. communicating scientific information	Apply: a. facts, concepts and terminology b. methodologies and techniques c. methods of communicating scientific information.	Demonstrate the appropriate research, experimental, and personal skills necessary to carry out insightful and ethical investigations.

○ 授業計画 (Course schedule)

		評価規準 Evaluation Criteria				Alotted hours	
単元の具体的な指導目標 Unit Objectives		指導項目・内容 Topic / Contents	知 ①	思 ②	態 ③	配当 時数	
1学期 (1st semester)	A. Space, time, and motion 1 【Knowledge and Skills】 <ul style="list-style-type: none"> Develop understanding of motion with constant acceleration, the forces that cause the motion (Newton's Laws), energy & power and momentum 【Ability to think, make judgements, express themselves】 <ul style="list-style-type: none"> Be able to use the concepts of equations of motion, Newton's laws, energy considerations, and momentum to solve problems Be able to apply the concepts of the equations of motion, Newton's laws, energy considerations, impulse & momentum to carry out practical investigation 【Motivation to learn, Humanity】 <ul style="list-style-type: none"> Engages actively in the practicals Work collaboratively with other classmates during practicals 	Contents: ・ Kinematics, Forces, Work, Energy & Power, and Impulse & Momentum Teaching materials: ・ Textbook, PowerPoint slides, Online Interactive Simulations (e.g. PhET, JavaLab, Phyphox)	①【Knowledge/Skills】 <ul style="list-style-type: none"> Short test, Examination, Lab report ②【Ability to think/make judgements/express themselves】 <ul style="list-style-type: none"> Examination, Poster presentation ③【Attitude towards learning proactively】 <ul style="list-style-type: none"> Reflection 	○	○	○	45
	A. Space, time, and motion 2 【Knowledge and Skills】 <ul style="list-style-type: none"> Develop understanding of rotational and angular motion of rigid objects Develop understanding of frames of reference and relativistic motion 【Ability to think, make judgements, express themselves】 <ul style="list-style-type: none"> Be able to use the concepts of torque, moment of inertia, angular velocity, angular acceleration, and angular momentum to solve problems Be able to use the concept of frame of reference and Einstein's special relativity theory to solve problems involving objects moving at the speed of light 【Motivation to learn, Humanity】 <ul style="list-style-type: none"> Engages actively in the practicals Work collaboratively with other classmates during practicals 	Contents: ・ Rigid Body Mechanics (Torque, 2nd condition of equilibrium and rotational motion with constant and varying circular acceleration) ・ Galilean transformation equations and special theory of relativity ・ Einstein's special relativity theory ・ Relativistic motion effects (time dilation and length contraction) Teaching materials: ・ Textbook, PowerPoint slides, Online Interactive Simulations (e.g. PhET, JavaLab, Phyphox)	①【Knowledge/Skills】 <ul style="list-style-type: none"> Short test, Examination, Lab report ②【Ability to think/make judgements/express themselves】 <ul style="list-style-type: none"> Examination, Poster presentation ③【Attitude towards learning proactively】 <ul style="list-style-type: none"> Reflection 	○	○	○	38
	定期考査 Examination		○	○			1

	単元の具体的な指導目標 Unit Objectives	指導項目・内容 Topic / Contents	評価規準 Evaluation Criteria	知 ①	思 ②	態 ③	配当 時数
2学期 (2nd semester)	B. The particulate nature of matter 【Knowledge and Skills】 <ul style="list-style-type: none"> Develop understanding of heat exchange and phase change Develop understanding of thermal equilibrium and the relationship between internal energy, heat, and work done on or by a system Develop understanding of how green house effect happen, what causes it, and its effect on the climate Develop understanding of electrical circuits involving resistors, capacitors, and transformers 【Ability to think, make judgements, express themselves】 <ul style="list-style-type: none"> Be able to use $Q=mc\Delta T$ to solve problems Be able to analyze PV-graph of a thermodynamic cycle Be able to use Ohm's law and Kirchhoff's laws to solve problems in electrical circuits Be able to analyze and model climate balance in terms of energies absorbed by greenhouse gases 【Motivation to learn, Humanity】 <ul style="list-style-type: none"> Engages actively in the practicals Work collaboratively with other classmates during practicals 	Contents: <ul style="list-style-type: none"> Thermal energy transfer, relation between thermal energy, mass and change in temperature using the relationship $Q=mc\Delta T$ Gas laws at constant pressure, at constant volume, and at constant Laws of Thermodynamics, entropy, thermodynamic cycles Greenhouse effect and the gases in the atmosphere that cause such an effect Current and circuits (Ohm's law, circuits using resistors, capacitors, transformers, Kirchhoff's laws) Teaching materials: <ul style="list-style-type: none"> Textbook, PowerPoint slides, Online Interactive Simulations (e.g. PhET, JavaLab, Phyphox) 	①【Knowledge/Skills】 <ul style="list-style-type: none"> Short test, Examination, Lab report ②【Ability to think/make judgements/express themselves】 <ul style="list-style-type: none"> Examination, Poster presentation ③【Attitude towards learning proactively】 <ul style="list-style-type: none"> Reflection 	○	○	○	30
	C. Waves behaviour 【Knowledge and Skills】 <ul style="list-style-type: none"> Develop understanding of harmonic motion the relationships between period, frequency, amplitude, displacement, and phase difference Develop understanding of the properties of mechanical waves (transverse, longitudinal, standing waves) Develop understanding of standing waves and resonance Develop understanding of sound waves and its behaviour in different mediums Develop understanding of electromagnetic waves (light) and the concepts of diffraction and interference 【Ability to think, make judgements, express themselves】 <ul style="list-style-type: none"> Be able to solve problems involving the superposition of waves and the inverse square law 【Motivation to learn, Humanity】 <ul style="list-style-type: none"> Engages actively in the practicals Work collaboratively with other classmates during practicals. 	Contents: <ul style="list-style-type: none"> Simple harmonic motion which is then related to uniform circular motion Wave model (transverse and longitudinal waves) Wave phenomenon (constructive and destructive interference, single-slit and double-slit diffraction) Standing wave and resonance (standing waves in an oscillating string and resonance effect of sound in an open-end and close-end pipes) Doppler Effect (sound waves and electromagnetic waves - red shift & blue shift) Teaching materials: <ul style="list-style-type: none"> Textbook, PowerPoint slides, Online Interactive Simulations (e.g. PhET, JavaLab, Phyphox) 	①【Knowledge/Skills】 <ul style="list-style-type: none"> Short test, Examination, Lab report ②【Ability to think/make judgements/express themselves】 <ul style="list-style-type: none"> Examination, Poster presentation ③【Attitude towards learning proactively】 <ul style="list-style-type: none"> Reflection 	○	○	○	30

	単元の具体的な指導目標 Unit Objectives	指導項目・内容 Topic / Contents	評価規準 Evaluation Criteria	知 ①	思 ②	態 ③	配当 時数
3学期 (3rd semester)	D. Fields 【Knowledge and Skills】 <ul style="list-style-type: none"> Develop understanding of gravitational fields and its effects on massive objects (e.g. planets and stars) Develop understanding of electric field and its effect on stationary charges Develop understanding of magnetic fields and its effects on stationary and moving charges Develop understanding of the behaviour of electromagnetic waves Develop understanding of how current and electromotive force (emf) are induced when the magnetic flux is varied over a period of time 【Ability to think, make judgements, express themselves】 <ul style="list-style-type: none"> Be able to calculate gravitational potential and gravitational potential energy Be able to apply Coulomb's law to determine the electric force acting on a stationary charged particle Be able to apply Lorentz force to determine the magnetic force acting on a moving charged particle Be able to calculate the magnetic force and magnetic field produced by a current-carrying wire Be able to calculate the current and emf induced given a time-varying magnetic flux 【Motivation to learn, Humanity】 <ul style="list-style-type: none"> Engages actively in the practicals Work collaboratively with other classmates during practicals 	Contents: <ul style="list-style-type: none"> Gravitational fields (gravitational force and motion of massive objects, gravitational potential, gravitational potential energy) Electric field (Coulomb's law, electric potential and electric potential energy) Magnetic fields (Lorentz force, magnetic field generated by a current-carrying wire, a solenoid) Motion in electromagnetic (EM) fields (effect on the motion of charged particles in an EM field) Induction (induced current and electromotive force in a time-varying magnetic field) Teaching materials: <ul style="list-style-type: none"> Textbook, PowerPoint slides, Online Interactive Simulations (e.g. PhET, JavaLab, Phyphox) 	①【Knowledge/Skills】 • Short test, Examination, Lab report ②【Ability to think/make judgements/express themselves】 • Examination, Poster presentation ③【Attitude towards learning proactively】 • Reflection	○	○	○	35
	定期考查 Examination			○	○		1
	E. Nuclear and Quantum Physics 【Knowledge and Skills】 <ul style="list-style-type: none"> Develop understanding of the Bohr model of the atom and how it relates to Rutherford scattering experiment Develop understanding of the various concepts in Quantum Physics Develop understanding of the various concepts of radioactive decay Develop understanding of the difference between fission and fusion and how stars exhibit such reactions)Bohr model of the 【Ability to think, make judgements, express themselves】 <ul style="list-style-type: none"> Be able to solve problems using the photoelectric effect equation, the de Broglie wavelength of matter waves, quantization of energy in a hydrogen atom Be able to apply Heisenberg's uncertainty principle to predict the position and velocity of a particle Be able to calculate the half-life, activity, and decay of certain radioactive materials Be able to calculate the mass defect in a fission or fusion reaction using the equation $\Delta E = \Delta m \cdot c^2$ Be able to plot the relationship between the intrinsic brightness of stars with respect to the temperature observed based on Wein's law 【Motivation to learn, Humanity】 <ul style="list-style-type: none"> Engages actively in the practicals Work collaboratively with other classmates during practicals 	Contents: <ul style="list-style-type: none"> Structure of the atom (Bohr model of the atom, Rutherford's scattering and the nuclear radius) Quantum Physics (Planck's relationship, absorption and emission spectra, photoelectric effect, matter waves, pair production and annihilation, quantization of energy and angular momentum, the wave function, probability density, position-momentum and energy-time Heisenberg's uncertainty principle) Radioactive decay (the law of radioactive decay and the decay constant, alpha and beta decay, nuclear energy levels, the neutrino) Fission (mass defect when a nucleus undergo fission) Fusion and stars (how stars turn matter into energy, stellar evolution, Wein's law, Hertsprung-Russell diagram, red shift & Hubble's law, supernovae) Teaching materials: <ul style="list-style-type: none"> Textbook, PowerPoint slides, Online Interactive Simulations (e.g. PhET, JavaLab, Phyphox) 	①【Knowledge/Skills】 • Short test, Examination, Lab report ②【Ability to think/make judgements/express themselves】 • Examination, Poster presentation ③【Attitude towards learning proactively】 • Reflection	○	○	○	53
	定期考查 Examination			○	○		1