LAW TING PONG SECONDARY SCHOOL

S. 4 Physics

Course Outline (2020-2021)

1. General Description

Physics is one of the most fundamental natural sciences. It involves the study of universal laws, and of the behaviors and relationships among a wide range of physical phenomena. Through the learning of physics, students will acquire conceptual and procedural knowledge relevant to their daily lives. In addition to the relevance and intrinsic beauty of physics, the study of physics will enable students to develop an understanding of its practical applications in a wide variety of fields. With a solid foundation in physics, students should be able to appreciate both the intrinsic beauty and quantitative nature of physical phenomena, and the role for physics in many important developments in engineering, medicine, economics and other fields of science and technology.

2. Learning Objectives

The physics curriculum aims to provide physics-related learning experiences for students to develop scientific literacy, so that they can participate actively in our rapidly changing knowledge-based society, prepare for further studies or careers in fields related to physics, and become lifelong learners in science and technology.

By the end of S.4, students will be able to,

- Develop interest in the physical world and maintain a sense of wonder and curiosity about it;
- Construct and apply knowledge of physics, and appreciate the relationship between physical science and other disciplines;
- Appreciate and understand the nature of science in physics-related contexts;
- Develop skills for making scientific inquiries;
- Develop the ability to think scientifically, critically and creatively, and to solve problems individually or collaboratively in physics- related contexts;
- Understand the language of science and communicate ideas and views on physics-related issues;
- Make informed decisions and judgements on physics-related issues; and
- Be aware of the social, ethical, economic, environmental and technological implications of physics and developed attitude of responsible citizenship.

3. Teaching Schedule

Date	Week	Topic	Chapter
1/9 – 16/10	1-7	Heat and Gases	**(Book 1) Chapter 1 Temperature and Thermometers** **Learning Objectives:** ✧ **1.1 Temperature and the temperature scale** - State temperature as the degree of hotness of an object. - Define degree Celsius as a unit of temperature. ✧ **1.2 Thermometers** - Explain the use of temperature-dependent properties in measuring temperature. - Explain the calibration of liquid-in-glass thermometer. **Formative Practice:** - Read and discuss the history of the 'Celsius temperature scale' development. - Complete chapter worksheet and tabulate the differences between different thermometers.
			(Book 1) Chapter 2 Heat and Internal Energy **Learning Objectives:** ✧ **2.1 Internal Energy** - State the factor of mass, temperature and state of matter on the internal energy of a system. - Relate internal energy to the sum of kinetic energy and potential energy of particles in a system.

			- State that heat is the energy transferred as a result of the temperature difference between two objects. ✧ **<u>2.2 Specific heat capacity</u>** - Define heat capacity as $C = \frac{Q}{\Delta T}$ and specific heat capacity as $c = \frac{Q}{m\Delta T}$. - State the importance of the high specific heat capacity of water. - Solve problems involving heat capacity and specific heat capacity. **<u>Formative Practice:</u>** - Participate in an experiment to measure the specific heat capacity of water. - Conduct an experiment to measure the specific heat capacity of metal blocks. - Draw the experiment set-up with appropriate annotations. - Conduct a research project on how the high specific heat capacity of water is being used in human society/ affects the natural environment. **<u>Assessment:</u>** Test 1 (Book 1 Chapter 1 & Chapter 2)
			(Book 1) Chapter 3 Change of State **<u>Learning Objectives:</u>** ✧ **<u>3.1 Latent Heat</u>** - State that latent heat as the energy transferred during the change of state without temperature change.

			- Define specific latent heat of fusion as $\ell_f = \frac{Q}{m}$. - Define specific latent heat of vaporization as $\ell_v = \frac{Q}{m}$. - Solve problems involving latent heat. ✧ **3.2 Evaporation** - Identify the occurrence of evaporation below boiling point. - State the factors affecting rate of evaporation. **Formative Practice:** - Conduct an experiment on latent heat of water (Fusion/ melting). - Draw the heating curve and cooling curve based on experimental data. - Design an experiment to study the factors affecting the rate of evaporation. **Assessment:** Test 2 (Book 1 Chapter 3)
19/10 – 23/10	8	Wave Motion	**(Book 3A) Chapter 3 Lens Formula** **Learning Objectives:** ✧ **3.2 Images formed by a convex lens** **3.3 Images formed by a concave lens** - Apply $\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$ to solve problems for a single lens.

			Formative Practice: - Complete chapter worksheet. - Conduct an experiment to verify the lens formula. - Discuss the application of lens in daily life and scientific settings.
26/10 – 6/11	9 - 10	Force and Motion	**(Book 2) Chapter 1 Motion (I)** **Learning Objectives:** ✧ **1.1 Length and time** **1.2 Distance and displacement** - Present information on displacement-time graphs for moving objects. - Distinguish between scalar and vector quantities. - Use scalars and vectors to represent physical quantities. ✧ **1.3 Speed, velocity and acceleration** **1.4 Motion along a straight lines** - Define speed, velocity and acceleration. - Describe the motion of objects in straight line motion using speed, velocity, acceleration. **Formative Practice:** - Draw a flow chat that relates displacement, velocity and acceleration. - Discuss and suggest the examples of straight line motions in daily life.

			(Book 2) Chapter 2 Motion (II) **Learning Objectives:** ✧ **2.1 Graphs of straight-line motion** - Present information of moving objects using s-t, v-t, a-t graphs. - Interpret the uniform motion of objects using algebraic and graphical methods. - ✧ **2.2 Equations of uniformly accelerated motion** - Derive equations of uniformly accelerated motion $v = u + at$ $s = \frac{1}{2}(u + v)t$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$ - Solve problems involving objects in uniformly accelerated motion. **Formative Practice:** - Complete chapter worksheet and derive the 4 equations of uniformly accelerated motion. - Study the s-t, v-t, a-t graph using motion sensors and software. - Conduct an experiment of free-falling with constant gravitational acceleration. **Assessment:** Test 2 (Book 3A Chapter 3, Book 1 Chapter 1 & Chapter 2)
9/11 – 13/11	11	**Term Break**	

16/11 – 18/12	12 - 16	Force and Motion	**(Book 2) Chapter 3 Force and Motion (I)** **Learning Objectives:** ✧ **3.1 Introduction to forces** - Discuss the effect of force ✧ **3.2 Inertia and Newton's first law** - Describe the meaning of inertia and it's relationship to mass. - State Newton's First law of motion and use it to explain objects at rest or in uniform motion. ✧ **3.3 Net force and motion: Newton's second law** - State Newton's second law. - Use free-body diagrams to show the forces acting on objects. - Apply Newton's second law to solve problems. ✧ **3.5 Action and reaction: Newton's third law** - Realize forces are acting in pairs. - State Newton's Third law of motion and identify action and reaction pair of forces. **Formative Practice:** - Complete chapter worksheet. - Conduct an experiment on Newton's Second Law using carts and tracks. - Discuss daily life phenomenon with the 3 Newton's Laws.
21/12 – 1/1	17 - 18	**Christmas Holiday**	

<table>
<tr><td>4/1 – 22/1</td><td>19 - 21</td><td>Force and Motion</td><td><u>(Book 2) Chapter 5 Moment of a Force</u>

<u>Learning Objectives:</u>
✧ <u>5.1 The turning effect of a force</u>
- Define moment of a force as the product of the force and its perpendicular distance from the pivot.
- Discuss the uses of torques and couples.

✧ <u>5.2 Equilibrium of a rigid body</u>
- State the conditions for equilibrium of forces acting on a rigid body and solve problems involving a fixed pivot.

<u>Formative Practice:</u>
- Conduct an experiment of turning a door with different distances away from the pivot.
- Discuss daily life experiences/ phenomenon which involves moment of force.

<u>Assessment:</u>
Test 3 (Book 2 Chapter 1 to Chapter 3)</td></tr>
<tr><td></td><td></td><td></td><td><u>(Book 2) Chapter 6 Work, Energy and Power</u>

<u>Learning Objectives:</u>
✧ <u>6.1 Work and energy transfer</u>
- Interpret mechanical work as a way of energy transfer
- Define mechanical work done $W = Fs\cos\theta$</td></tr>
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			✧ **<u>6.2 Kinetic energy and potential energy</u>** - State that Kinetic energy is the energy possess by an object due to its motion - Derive $K.E. = \frac{1}{2}mv^2$ - State that gravitational potential energy is the energy possess by an object due to its position under gravity. - Derive $P.E. = mgh$ **<u>Formative Practice:</u>** - Complete chapter worksheet. - Discuss and suggest daily life/ scientific examples which involve KE and PE.
25/1 – 10/2	22 - 24	**<u>Mid-year Summative Assessment</u>** **(2.5 weeks)**	
11/2 – 19/2	24 - 25	**<u>Lunar New Year Holiday</u>**	
22/2 – 19/3	26 - 29	<u>Force and Motion</u>	**<u>(Book 2) Chapter 6 Work, Energy and Power</u>** **<u>Learning Objectives:</u>** ✧ **<u>6.3 Energy changes and conservation of energy</u>** - State the law of conservation of energy. - Solve problems involving conservation of energy. ✧ **<u>6.4 Power</u>** - Apply $P = \frac{W}{t}$ to solve problems.

			Formative Practice: - Watch a video of energy conversion in roller coaster. - Conduct a research project on amusement facilities which make use of conservation of energy. - Complete chapter exercises. **Assessment:** Test 4 (Book 2 Chapter 5 to Chapter 6)
			(Book 2) Chapter 7 Momentum **Learning Objectives:** ✧ **7.1 Conservation of momentum** - Define momentum p=mv - State the law of conservation of momentum. - Distinguish between elastic and inelastic collisions. - Solve problems involving momentum in one dimension. ✧ **7.2 Change in momentum** - Understand that a net force acting on an object for a period of time results in a change in momentum. - Interpret force as the rate of change of momentum. **Formative Practice:** - Complete chapter worksheet.

			- Watch a video of car crash test and analyze with the concepts of momentum. - Watch the video of an impact force experiment with data-logger. **Assessment:** Test 5 (Book 2 Chapter 7)
23/3 – 26/3	30	**ELW** (1 week)	
29/3 – 6/4	31 - 32	**Easter Holiday**	
7/4 – 30/4	32 -35	Heat and Gases	**(Book 1) Chapter 5 Gases** **Learning Objectives:** ✧ **5.1 The gas laws** - Understand the basic concept of gas pressure. - Study Boyle's law, Charles law and pressure law. - Determine absolute zero by the extrapolation of P-T or V-T relationships - State the general gas law pV=nRT - Apply the general gas law to solve problems. **Formative Practice:** - Complete chapter worksheet. - Watch 3 videos for (i) Boyle's Law, (ii) Charles Law and (iii) Pressure Law. - Conduct experiments on (i) Boyle's Law, (ii) Charles Law and (iii) Pressure Law.

			Assessment: Test 6 (Book 1 Chapter 5)
2/5 – 4/6	36 - 40	Wave Motion	**(Book 3B) Chapter 4 Nature of Waves** **Learning Objectives:** ✧ **4.1 Wave motion** - Interpret wave motion in terms of oscillation - Realize waves as transmitting energy without transferring matter - Distinguish between transverse wave and longitudinal wave. ✧ **4.2 Particle vibrations and wave motion** - Describe wave motion in terms of amplitude, period, frequency, wavelength, wave speed,, phase, displacement. - Apply $f=\frac{1}{T}$ and $v=f\lambda$ to solve problems. ✧ **4.3 Graphical descriptions of transverse waves** - Present information on displacement-time and displacement-distance graphs for travelling waves. **Formative Practice:** - Complete chapter worksheet. - Watch videos and simulations which illustrate wave motions. - Annotate and identify particle vibrations in waves using graphs

			(Book 3B) Chapter 5 Wave Phenomena and Stationary Waves **Learning Objectives:** ✧ **5.1 Studying wave phenomena using water waves** **5.2 Wave phenomena: Reflection and refraction** - Realize the reflection of waves at a plane/barrier/reflector/surface - Realize the refraction of waves across a plane boundary - Examine the change in wave speeds during refraction ✧ **5.3 Wave phenomena: diffraction** - Describe the diffraction of waves through a narrow gap and around a corner. **Formative Practice:** - Discuss daily life phenomenon/ examples which showed the properties of waves. - Design a leaflet to illustrates different types of waves in daily life.
7/6 – 9/6	41	Final Exam Revision	
10/6 – 25/6	41 - 43	Final Examination	

4. Course materials

Oxford Textbook Book 1 – Book 5 (Compulsory Part)
Oxford Textbook Book E2, E3 (Elective Part)
Chapter teaching notes/ Homework

5. Continuous Assessment (CA), Mid-year Summative Assessment and Final Exam

Throughout the school year, there are continuous assessment, a mid-year summative assessment and a final examination. For continuous assessment, it includes homework, class work and tests which would be conducted throughout the school term. For mid-year summative assessment, it would take place in January. For final examination, it will take place at the end of school year.

6. Assessment Components and Weighting (S.4 – S.5)

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7. Mark ranges for Physics subject

Senior forms (S.4 – S.6)

Performance Level	Mark range (%)
5*	80 – 100
5	70 – 79
4	60 – 69
3	46 – 59
2	33- 45
1^	0 – 32

For level descriptors, please refer to the information provided by the Hong Kong Examination and Assessment Authority (HKEAA) at the following link:
https://www.hkeaa.edu.hk/DocLibrary/HKDSE/Subject_Information/phy/phy-LevelDescriptors-e.pdf

8. The Independent Learning Scheme

The Independent Study Scheme (ISS) is an independent work implemented in all major subjects, and it's aim is to provide extended learning opportunities for students to consolidate their subject learning outside normal lessons. Apart from regular learning and assessment activities, the ISS is also implemented as a school-based learning activity in the physics subject, and students will be required to complete a mini project-type assignment per each term. ISS in physics subject is expected to built on the foundation of the 5 core topics in the senior secondary physics curriculum, and students are expected to practice and develop their independent study skills, problem solving skills as they extend their knowledge through the ISS assignments.

LAW TING PONG SECONDARY SCHOOL

S. 5 Physics

Course Outline (2020-2021)

1. General Description

Physics is one of the most fundamental natural sciences. It involves the study of universal laws, and of the behaviors and relationships among a wide range of physical phenomena. Through the learning of physics, students will acquire conceptual and procedural knowledge relevant to their daily lives. In addition to the relevance and intrinsic beauty of physics, the study of physics will enable students to develop an understanding of its practical applications in a wide variety of fields. With a solid foundation in physics, students should be able to appreciate both the intrinsic beauty and quantitative nature of physical phenomena, and the role for physics in many important developments in engineering, medicine, economics and other fields of science and technology.

2. Learning Objectives

The physics curriculum aims to provide physics-related learning experiences for students to develop scientific literacy, so that they can participate actively in our rapidly changing knowledge-based society, prepare for further studies or careers in fields related to physics, and become lifelong learners in science and technology.

By the end of S.5, students will be able to,

- Develop interest in the physical world and maintain a sense of wonder and curiosity about it;
- Construct and apply knowledge of physics, and appreciate the relationship between physical science and other disciplines;
- Appreciate and understand the nature of science in physics-related contexts;
- Develop skills for making scientific inquiries;
- Develop the ability to think scientifically, critically and creatively, and to solve problems individually or collaboratively in physics-related contexts;
- Understand the language of science and communicate ideas and views on physics-related issues;
- Make informed decisions and judgements on physics-related issues; and
- Be aware of the social, ethical, economic, environmental and technological implications of physics and developed attitude of responsible citizenship.

3. Teaching Schedule

Date	Week	Topic	Chapter
1/9 – 18/9	1 - 3	Wave Motion	**(Book 3B) Chapter 5 Wave Phenomena and Stationary Waves** **Learning Objectives:** ✧ **5.5 Stationary waves** - Explain the formation of stationary waves. - Describe the characteristics of stationary waves. **Formative Practice:** - Watch a simulation on the formation of stationary wave. - Watch a video on the motion of stationary wave. - Annotate the structure of a stationary wave using simulations and examples. - Complete chapter exercises.
			(Book 3B) Chapter 7 Sound **Learning Objectives:** ✧ **7.1 Longitudinal Waves** **7.2 Wave nature of sound** - Realize sound as an example of longitudinal waves - Realize that sound can exhibit the 4 properties of waves (i.e., reflection, refraction, diffraction and interference) - Realize the need for a medium for sound transmission.

			✧ **7.3 Musical notes and noise** - Determine the meaning of audible frequency range - Compare musical notes using pitch, loudness and quality **<u>Formative Practice:</u>** - Conduct an experiment of microphone with different pitch, loudness and quality. - Tabulate the relationship between sound wave properties and music notes properties. **<u>Assessment:</u>** Test 1 (Book 3B Chapter 5 & 7)
21/9 – 25/9	4	<u>Heat and Gases</u>	**(Book 1) Chapter 5 Gases** **<u>Learning Objectives:</u>** ✧ **5.2 Kinetic Theory of Gases** - Realize the random motion of molecules in a gas - Realize the gas pressure resulted from molecular bombardment - State the assumptions of the kinetic model of an ideal gas - Realize the connection of microscopic and macroscopic quantities in Kinetic Theory. **<u>Formative Practice:</u>** - Discuss the assumptions of ideal gases. - Investigate kinetic theory of gas using the mechanical simulator. - Derive the kinetic theory of gas with the support of graphical illustrations.

28/9 – 6/11	5 - 10	Force and motion	**(Book 2) Chapter 9 Uniform Circular motion** **Learning Objectives:** ✧ **9.1 Introduction to circular motion** - Define angular displacement and angular velocity to describe circular motion. ✧ **9.2 Centripetal force** - Understand the concept of centripetal force $F=mv^2/r$ - Solve problems involving uniform circular motion **Formative Practice:** - Draw daily life examples which involves uniform circular motion. - Watch a video of an athlete demonstrating hammer in Olympics (Centripetal force) - Conduct a centripetal force experiment with turning wheels.
			(Book 2) Chapter 10 Gravitation **Learning Objectives:** ✧ **10.1 Newton's law of universal gravitation** - State and apply Newton's law of Universal gravitation $F=Gm_1m_2/r^2$ - Define gravitational field strength. ✧ **10.2 Circular motion under gravity** - Determine the velocity of an object in a circular orbit - Solve the case of geosynchronous satellite

			<u>Formative Practice:</u> - Watch a video of moon orbiting around the Earth. - Conduct a research project on artificial satellites in space. **<u>Assessment:</u>** Test 2 (Book 2 Chapter 9 and 10)
9/11 – 13/11	**11**	**Term Break**	
16/11 – 18/12	**12 – 16**	<u>Electricity and Magnetism</u>	**(Book 4) Chapter 1 Electrostatics** **<u>Learning Objectives:</u>** ✧ **1.1 Electric charge and electric fields** - Realize the attraction and repulsion between charges. - Interpret charging in terms of electron transfer. - Represent electric field using field lines. ✧ **1.2 More about electric fields** - State Coulomb's Law $F = \frac{Q_1 Q_2}{4\pi\varepsilon_o r^2}$ - Solve problems involving a point charge. - Determine electric field strength around a point charge $E = \frac{Q}{4\pi\varepsilon_o r^2}$ and between parallel plates $E = \frac{V}{d}$.

			<u>Formative Practice:</u> - Complete chapter worksheet. - Conduct an experiment to show electrostatic with a gold leaf device, and a rubbed ruler. - Draw electric field lines for positive charge, negative charge, and multiple charges. - Draw electric field lines in parallel plate cases.
			(Book 4) Chapter 2 Electric Circuits **<u>Learning Objectives:</u>** ✧ **2.1 Electric current** - Define electric current as the rate of flow of electric charges - State the convention for the direction of electric current ✧ **2.2 Voltage, electromotive force, potential difference** - Describe energy transformations in electric circuits. - Define Potential difference (p.d.) and electromotive force (e.m.f.) ✧ **2.3 Resistance** - Define resistance $R = \frac{V}{I}$ - Realize Ohm's law as a special case of resistance behavior. **<u>Formative Practice:</u>** - Measure current using an ammeter. - Measure voltage using a voltmeter.

			- Conduct an experiment on Ohm's law with report writing. - Build a circuit to measure voltage and resistance. - Watch a video on finding the internal resistance of a cell.
21/12 – 1/1	**17-18**	**Christmas holiday**	
4/1 – 22/1	**19-21**	Electricity and Magnetism	**(Book 4) Chapter 2 Electric Circuits** **Learning Objectives:** ✧ **2.4 Resistors in series and in parallel** - Compare series and parallel circuits in terms of p.d. across components and the current through them. - Derive the resistance combinations in series and parallel. - Solve problems involving simple circuits ✧ **2.5 Resistance of ammeters, voltmeters and power sources** - Identify the resistance properties of a good ammeter, voltmeter and power sources. **Formative Practice:** - Draw circuit diagrams. - Conduct an experiment on series and parallel circuit with report writing. - Tabulate the resistance properties of ammeter, voltmeter.

			(Book 4) Chapter 3 Domestic Electricity **<u>Learning Objectives:</u>** ✧ **3.1 Electrical power and energy** - Apply P=VI to solve problems. - Determine the power rating of electrical appliances. - Use kilowatt-hour (kW h) as a unit of electrical energy. ✧ **3.2 Mains electricity and household wiring** - Determine the operating current for electrical appliances. - Understand household wiring and discuss safety aspects of domestic electricity. **<u>Formative Practice:</u>** - Conduct a survey to record household electrical appliances power. - Discuss household safety in using household electrical appliances.
25/1 - 102	**22-24**	**Mid-year summative assessment**	
11/2 – 19/2	**24 - 25**	**Lunar New Year holiday**	
22/2 – 26/2	**26**	**S.5 SBA**	
22/2 – 19/3	26 - 29	<u>Electricity and Magnetism</u>	**(Book 4) Chapter 4 Electromagnetism** **<u>Learning Objectives:</u>** ✧ **4.1 Magnetic forces and magnetic fields** - Examine the magnetic field around a magnet. - Represent magnetic field using field lines graphically.

			✧ **4.2 Magnetic fields of electric currents** - Examine the magnetic field patterns associated with current-carrying long straight wires, circular coils and long solenoids - Identify the factors affecting the strength of an electromagnet. ✧ **4.3 Force due to magnetic fields** - Study the force acting on a current-carrying wire in a magnetic field $F=BIL \sin\theta$. - Determine the turning effect on a current-carrying coil in a magnetic field. - Know how a d.c. motor and related appliances work. ✧ **4.4 Magnetic forces on moving charges** - Represent the force on a moving charge in a magnetic filed by $F=BQv \sin\theta$. **<u>Formative Practice:</u>** - Conduct an experiment of iron powder with magnet to observe magnetic field lines. - Observe and draw magnetic field lines in a 3D magnet model. - Conduct an experiment to observe magnetic field lines of electric wires, coils and solenoid using compasses. - Discuss the application of electromagnets. **<u>Assessment:</u>** Test 3 (Book 4 Chapter 1 to 3)
23/3 – 26/3	30	**ELW**	
29/3 - 6/4	31-32	**Easter Holiday**	

7/4 – 14/5	32 - 37	Electricity and Magnetism	**(Book 4) Chapter 5 Electromagnetic Induction** **Learning Objectives:** ✧ **5.1 Current generation in a magnetic field** - Examine induced e.m.f. resulting from a moving conductor in a steady magnetic field or a stationary conductor in a changing magnetic field. - Apply Fleming's right-hand rule and Lenz's law to determine direction of induced current. ✧ **5.2 Faraday's law and magnetic flux** - Define magnetic flux $\Phi = BA\cos\theta$. - State Faraday's law and apply it to calculate average induced e.m.f. - Examine magnetic field using a search coil. ✧ **5.3 Applications of electromagnetic induction** - Understand the structure of simple d.c. and a.c. generator. - Discuss the occurrence and practical uses of eddy current **Formative Practice:** - Watch a video on electricity generation. - Conduct an experiment of jumping ring, coin detector, braking effect of eddy currents. - Build a self-rotating motor DIY.

			(Book 4) Chapter 6 Transmission of Electrical Energy **<u>Learning Objectives:</u>** ✧ **6.1 Alternating currents** - Define r.m.s quantities of a.c. currents in terms of current, voltage and power. - Relate the r.m.s and peak values of a a.c. ✧ **6.2 Transformers and high voltage transmission** - Describe the structure of a simple transformer and how it works. - Relate the voltage ratio to turn ratio by $\frac{V_P}{V_S}=\frac{N_P}{N_S}$ and apply it to solve problems. - Suggest methods for improving transformer efficiency - Discuss the advantages of transmission of electrical energy with a.c. at high voltages. - State the meaning of step up and step down transformers in power transmission. **<u>Formative Practice:</u>** - Investigate the turn ratio of a transformer model. - Watch a video on power transmission using high voltage power grid. **<u>Assessment:</u>** Test 4 (Book 4 Chapter 5 to 6)

17/5 – 9/6	38 - 41	Radioactivity and Nuclear Energy	**(Book 5) Chapter 1 Radiation and Radioactivity** **Learning Objectives:** ✧ **1.1 X-rays and nuclear radiation** - Realize X-rays as ionizing electromagnetic radiations of short wavelengths with high penetrating power. - Explain the emission of X-rays when fast electrons hit a heavy metal target. - Discuss the application of X-rays. - State the origin and nature of α, β and γ radiations. ✧ **1.2 Radioactivity** - Compare α, β and γ radiations in terms of their ionizing power, penetrating power, range, behavior in electric field, magnetic field and cloud chamber tracks. **Formative Practice:** - Complete chapter worksheet. - Record the observation during teacher's demonstration on radioactive sources. - Tabulate the characteristics of α, β and γ radiations. - Watch a video on cloud chamber experiment.
			(Book 5) Chapter 2 Atomic Structure and Radioactive Decay **Learning Objectives:** ✧ **2.1 The atomic model** - Describe the structure of an atom.

			- Define atomic number and mass number of an atom. - Represent the basic structure of a nuclide by symbolic notation. - Define isotopes. - Realize the existence of radioactive isotopes in some elements. - ✧ **2.2 Radioactive decay** - Realize the occurrence of radioactive decay in unstable nuclides. - State three types of radioactive decay (i.e., Alpha decay, Beta Decay, Gamma Decay). - Represent radioactive transmutations in α, β and γ decays using equations. **<u>Formative Practice:</u>** - Draw and annotate the structure of an atom. - Identify the components of the equation for Alpha decay, Beta Decay, Gamma Decay - Design a leaflet to illustrate the differences of Alpha decay, Beta Decay, Gamma Decay
10/6 – 24/6	41	**<u>Final Examination</u>**	

4. Course materials

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Chapter teaching notes/ Homework

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Physics is one of the most fundamental natural sciences. It involves the study of universal laws, and of the behaviors and relationships among a wide range of physical phenomena. Through the learning of physics, students will acquire conceptual and procedural knowledge relevant to their daily lives. In addition to the relevance and intrinsic beauty of physics, the study of physics will enable students to develop an understanding of its practical applications in a wide variety of fields. With a solid foundation in physics, students should be able to appreciate both the intrinsic beauty and quantitative nature of physical phenomena, and the role for physics in many important developments in engineering, medicine, economics and other fields of science and technology.

2. Learning Objectives

The physics curriculum aims to provide physics-related learning experiences for students to develop scientific literacy, so that they can participate actively in our rapidly changing knowledge-based society, prepare for further studies or careers in fields related to physics, and become lifelong learners in science and technology.

By the end of S.6, students will be able to,

- Develop interest in the physical world and maintain a sense of wonder and curiosity about it;
- Construct and apply knowledge of physics, and appreciate the relationship between physical science and other disciplines;
- Appreciate and understand the nature of science in physics-related contexts;
- Develop skills for making scientific inquiries;
- Develop the ability to think scientifically, critically and creatively, and to solve problems individually or collaboratively in physics- related contexts;
- Understand the language of science and communicate ideas and views on physics-related issues;
- Make informed decisions and judgements on physics-related issues; and
- Be aware of the social, ethical, economic, environmental and technological implications of physics and developed attitude of responsible citizenship.

3. Teaching Schedule

Date	Week	Topic	Section
3/9 – 2/10	1 – 4	Radioactivity and Nuclear Energy	**Ch.26 Rate of Decay and Uses of Radionuclides** **Learning targets:** ✧ **26.1 Rate of radioactive decay** - Understand the random nature of radioactive decay - State the proportional relation between the activity of a sample and the number of undecayed nuclei - Define the half-life of a radioactive source - Realize the number of undecayed nuclei follows an exponential decay, $N = N_0e^{-kt}$, and apply the equation to solve problems ✧ **26.2 Uses of radionuclides** - Understand the uses of radioactive isotopes ✧ **26.3 Radiation safety** - Understand the potential hazards of ionizing radiation and the safety measures for handling radioactive sources **Formative Practices:** - Presentation & Research: do research and give presentations on how people apply half-life to solve problems in daily life.
			Ch.27 Nuclear Energy **Learning targets:** ✧ **27.1 Nuclear fission and fusion** - Understand what nuclear fission and chain reactions are - Understand what nuclear fusion is realize nuclear energy as an energy source and its potential hazards

			✧ **<u>27.2 Mass-energy relation</u>** - Determine the energy change in a nuclear reaction according to the mass-energy relation $\Delta E = \Delta mc^2$ **<u>Formative Practices:</u>** - Poster design: design a poster to summarize the conversion between kilogram, amu (atomic mass unit), Joule and electronvolt. - Uniform test (Ch.25, 26 & 27)
5/10 - 30/10	6 - 9	<u>Energy and Use of Energy</u>	**(E3) Ch.1 Lighting** **<u>Learning targets:</u>** ✧ **1.1 Domestic electricity** **1.2 Lighting** - Realize the energy changes involved in the use of domestic appliances - Understand what the Energy Efficiency Labelling Scheme is, and solve problems involving energy labels point out how to save energy when using electrical appliances - Define efficacy of electric lights - Describe the working principles and cost effectiveness of different kinds of lighting appliances, including incandescent lamps, gas discharge lamps and light emitting diodes (LED) - Realize how our eyes respond to light of different colours ✧ **1.3 Measuring illumination** - Define the unit used to measure the light energy emitted per unit time from a light source - calculate the light energy falling on a surface per unit time at a certain angle and distance from a light source **<u>Formative Practices:</u>** - Photo-taking activity: Take photos in electrical appliances shops or from daily life to give

			some examples of Energy Efficiency Labelling Scheme (EELS).
			(E3) Ch.2 Cooking and Air-Conditioning **<u>Learning targets:</u>** ✧ **2.1 Cooking without fire** - Describe how an electric hotplate, an induction cooker and a microwave oven work - Solve problems involving the power rating and end-use energy efficiency of different cooking appliances, and realize the pros and cons of using these electrical appliances ✧ **2.2 Moving heat around** - Describe how air conditioners work by transferring heat against the natural direction of heat flow - Interpret cooling capacity as the rate at which a cooling appliance is capable of removing heat from a room - Define coefficient of performance COP as ratio of cooling capacity to electrical power input - Understand how the heat generated by central air-conditioning systems can be utilized **<u>Formative Practices:</u>** - Diagram drawing: draw diagrams to show how heat transfer in air conditioners and central air-conditioning systems.
			(E3) Ch.3 Buildings and Transportation **<u>Learning targets:</u>** ✧ **3.1 Energy efficiency in buildings** - Describe the rate of energy transfer in building materials by conduction - Define the OTTV and discuss factors affecting OTTV - Solve problems involving conduction in a building - Explain how the use of solar control windows can reduce heat gain by radiation - State the factors affecting the energy efficiency of a building

			✧ **3.2 Energy efficiency in transportation** - Describe the main components of electric vehicles and hybrid vehicles - Compare the energy efficiency of hybrid vehicles with petrol vehicles - State the advantages of using mass transportation **<u>Formative Practices:</u>** - Summary table: give examples of electrical appliances in each aspect (Lighting, Cooking, Air-conditioner and Transportation) and calculate their end-use energy efficiency.
			(E3) Ch.4 Different Sources of Energy **<u>Learning targets:</u>** ✧ **4.1 Electricity and energy** **4.2 Energy sources** - Describe the nature of renewable and non-renewable energy sources and give examples - Understand some ways of utilizing solar energy - Estimate the power that can be obtained from a wind turbine - Explain the energy conversion process for hydroelectric power - Explain the meaning of binding energy in atomic nuclei, and its relation to nuclear fission and fusion - Describe the basic working principle of a fission reactor and some of its components ✧ **4.3 Energy, society and environment** - Discuss some impacts of the extraction, conversion, distribution and use of energy on the society and environment - Describe the consumption of different kinds of fuels in Hong Kong, and analyse their use and consumption data **<u>Formative Practices:</u>** - Debate: debate on the use of nuclear energy.
2/11 - 30/11	9 - 14	<u>Atomic World</u>	**(E2) Ch.1 The Photoelectric effect**

			<u>Learning targets:</u> ✧ **1.1 The photoelectric effect** - Understand the photoelectric effect and related experiments - State the properties of the photoelectric effect and the deficiencies of the wave theory of light in explaining them ✧ **1.2 The quantum theory of light** - State the basic idea of the quantum theory of light and show how it can explain the photoelectric properties - Realize that the photoelectric effect reveals the particle nature of light **<u>Formative Practices:</u>** - Watch animation about photoelectric effect and give verbal description about the process during the lesson. - Do research and give presentations about the application of photoelectric effect.
			(E2) Ch.2 Atomic Model and Spectra **<u>Learning targets:</u>** ✧ **2.1 Rutherford's atomic model** - Understand the history of the discovery of atomic structure. - Understand Rutherford's atomic model and its limitations. - Realize the importance of scattering experiments in the discovery of atomic structure and the search for new particles. ✧ **2.2 Atomic spectra** - State the features of the emission and absorption spectra of atoms. - Realize that line spectra reveal the discrete energy levels of atoms. ✧ **2.3 Bohr model of the hydrogen atom**

			- Understand the postulates of Bohr's atomic model - Use the Bohr model to explain the line spectrum of hydrogen **<u>Formative Practices:</u>** - Model design: use recycled paper to construct Rutherford's atomic model and Bohr model of the hydrogen atom. - Section quiz
			(E2) Ch.3 Nanotechnology ✧ **3.1 Matter waves** - Realize the wave-particle duality of light and describe its evidence - Realize the wave-particle duality of matter and describe its evidence - Relate the wave and particle properties of matter using the de Broglie relation - Understand the implication of wave-particle duality on the fundamental concepts of physics ✧ **3.2 Observing at the nanoscale** - Understand the meaning of resolving power and use the Rayleigh criterion to estimate the minimum angular separation of two resolvable point objects - State the working principles of some electron microscopes such as the TEM and STM ✧ **3.3 Materials in nanoscale** - Realize that nanomaterials exist in many different forms - Realize that materials exhibit special properties when they are reduced to nano size - Understand that the special properties of nanomaterials come from the large surface area to volume ratio and quantum effects ✧ **3.4 Recent development in nanotechnology** - Realize that nanotechnology has a wide range of applications but also a number of potential hazards

			<u>Formative Practices:</u> - Research & Presentation: observe and give daily life examples of the applications in nano-scale. - Uniform test (E2 & E3)

4. Course materials

Pearson Active PHYSICS for HKDSE (Radioactivity and Nuclear Energy)
Pearson Active PHYSICS for HKDSE (Atomic World) (E2)
Pearson Active PHYSICS for HKDSE (Energy and Use of Energy) (E3)

5. Continuous Assessment (CA), Mid-year Summative Assessment and Final Exam

Throughout the school year, there are continuous assessment, a mid-year summative assessment and a final examination. For continuous assessment, it includes homework, class work and tests which would be conducted throughout the school term. For mid-year summative assessment, it would take place in January. For final examination, it will take place at the end of school year.

6. Assessment Components and Weighting (S.6)

Components		**Weighting**
Continuous Assessment	Homework (10%)	40%
	Uniform Test (90%)	
Summative Assessment		60 %

7. Mark ranges for Physics subject

Senior forms (S.4 – S.6)

Performance Level	**Mark range (%)**
5*	80 – 100
5	70 – 79
4	60 – 69
3	46 – 59
2	33- 45
1^	0 – 32

For level descriptors, please refer to the information provided by the Hong Kong Examination and Assessment Authority (HKEAA) at the following link:
https://www.hkeaa.edu.hk/DocLibrary/HKDSE/Subject_Information/phy/phy-LevelDescriptors-e.pdf