Diploma Programme subject outline–Group 4: sciences					
School name	ELA GREEN SCHOOL			**School code**	**060876**
Name of the DP subject *(indicate language)*	Physics				
Level *(indicate with X)*	Higher	X	Standard completed in two years *		Standard completed in one year *
Name of the teacher who completed this outline	Roselin Mary.R		**Date of IB training**	3 May 2023	
Date when outline was completed	14 April 2023		**Name of workshop** *(indicate name of subject and workshop category)*	IB Category 1	

* All Diploma Programme courses are designed as two-year learning experiences. However, up to two standard level subjects, excluding languages ab initio and pilot subjects, can be completed in one year, according to conditions established in the *Handbook of procedures for the Diploma Programme*.

1. Course outline

– Use the following table to organize the topics to be taught in the course. If you need to include topics that cover other requirements you have to teach (for example, national syllabus), make sure that you do so in an integrated way, but also differentiate them using italics. Add as many rows as you need.

– This document should not be a day-by-day accounting of each unit. It is an outline showing how you will distribute the topics and the time to ensure that students are prepared to comply with the requirements of the subject.

– This outline should show how you will develop the teaching of the subject. It should reflect the individual nature of the course in your classroom and should not just be a “copy and paste” from the subject guide.

– If you will teach both higher and standard level, make sure that this is clearly identified in your outline.

	Topic/unit (as identified in the IB subject guide) *State the topics/units in the order you are planning to teach them.*	Contents	Allocated time One class is 45 minutes. In one week there are 6 classes.	Assessment instruments to be used	Resources *List the main resources to beused, including information technology if applicable.*
Year 1 July	**Skills in the study of Physics**	**Fundamental concepts in Physics:** **Tool 1 : Experimental techniques** • Making observations • Measuring variables **Tool 2 :Technology** **Tool 3 :Mathematics** • Summary of SI units • Processing uncertainities • Precision and accuracy • Errors in measurement • Relationships I. Linear relationships II. Non linear relationships III. Using logs • Uncertainity in the gradient • Fractional uncertainties • Vector and scalar quantities	About **5 teaching** hours for **Skills in the study of Physics (SL/HL)** • Measurement in physics (1.5 hours) • Uncertainties and errors (1.5 hours) • Vectors and scalars (1.5 hours) At the end of this topic, the students will take 30 minutes to communicate and reflect on the topic. **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Inquiring** ✧ **Knowledgeable**	❖ **Measurement in physics** • Formative assessment: (Exercises) According to the orders of magnitude. ❖ **Uncertainties anderrors** • Formative assessment (Experiment report) ❖ **Vectors and scalars** • Formative assessment (Exercises) • Questions from past examination papers about vectors and scalars.	✧ Websites: (1) https://resources.ibo.org/ (2) Diploma Programme Approaches to teaching and learningwebsite. https://xmltwo.ibo.org/publications/DP/Group0/d_0_dpatl_gui_1502_1/static/dpatl/guide-apr-to-learn.html ✧ Books: 1. Pearson Science for the IB Diploma 3rd edition https://www.pearsonactivelearn.com/app/library/series/view/1134387 2. Hodder Education Physics for the IB Diploma Third edition.
July/ August	**Topic A: space,time and motion**	**A.1 Kinematics:** • Distance and displacement • Velocity and Speed	About **9 teaching** hours for **Topic A.1 Kinematics (SL)**		

		I. Average velocity and Instantaneous velocity II. Constant Velocity III. Relative Velocity • Acceleration I. Constant acceleration in one dimension II. The signs of displacement, velocity and acceleration III. Free fall motion and Acceleration of free fall IV. Measuring the acceleration due to gravity • Graphical representation of Motion I. Gradient of displacement – time graph II. Gradient of velocity – time graph • Projectile motion I. Modeling Projectile motion II. Projectile motion with air resistance	**Skills:** ✧ **Thinking skills** ✧ **Research skills** ✧ **Self-management skills** **LPA:** ✧ **Knowledgeable**	• **Formative assessment:** 1.Exercises 2.Laboratory activities	https://www.hoddereducation.co.uk/subjects/ib-diploma/products/16-18/physics-for-the-ib-diploma-third-edition ✧ Past examination papers

September		**A.2 Forces and Momentum** • Force I. Addition of forces II. Taking components III. Equilibrium IV. Free-body diagrams • Newton's first law of motion • Types of force I. Tension II. Normal reaction III. Gravitational force (weight) IV. Electric and magnetic forces V. Friction VI. Dynamic friction VII. Static friction VIII. Buoyancy IX. Air resistance X. Elastic restoring force • The relationship between force and acceleration • Momentum • Impulse • Newton's Second law of motion • Examples • Newton's third law of motion • Examples	About **10 teaching** hours for **Topic A.2 Forces and momentum (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** ✧ **Self-management skills** **LPA:** ✧ **Principled** ✧ **Inquirers**	• **Summative assessment.** • **Experiment report:** Test the relationship between acceleration and force. (Use the knowledge of Topic A.1 to analyze the result.)	

		• Collisions • The law of conservation of momentum • Circular motion • Quantities of circular motion • Centripetal force • Examples			

October		**A.3 Work,Energy and Power:** • Work • Graphical method of determining work done • Work done by a varying force • Energy • Different types of Energy • Kinetic Energy • Gravitational Potential Energy • The Law of conservation of Energy • Stores of Energy • Energy transfer • Efficiency • Energy and collisions • Elastic collisions • Inelastic collisions • Explosions • Power • Examples • Efficiency and power	About **8 teaching** hours for **Topic A.3 Work,energy and power (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** ✧ **Self-management skills** **LPA:** ✧ **Enthusiasm**	Summative Assessment **Formative assessment** (Exercises)	

November		**<u>A.4 Rigid Body Mechanics : (HL)</u>** • Rotational motion • Torque I. Angular speed and angular acceleration • Equilibrium I. The balanced beam II. Levers III. The bridge • Non- perpendicular forces • Constant angular acceleration • Newton's second law applied to angular motion • Moment of inertia • Some common shapes and their moment of inertia • Rotational kinetic energy • Angular momentum	About **7 teaching** hours for **Topic A.4 Rigid Body Mechanics (HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Risk takers**	• **Formative assessment (Exercises)**	

December	**Topic D:Fields**	**<u>D.1 Gravitational Fields: (SL/HL)</u>** **<u>SL Topics: 5 Hours</u>** • Gravitational force and field I. Newton's universal law of gravitation II. Extended bodies III. Sphere of mass IV. How fast does the apple drop ? • Gravitational field I. Gravitational field strength II. Field lines • The Solar system I. Kepler's Laws II. Energy of an orbiting body III. Earth satellites	About **12 teaching** hours for **Topic D.1 Gravitational Fields (SL/HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Inquirers**	• **Formative Assessment (Exercises)** • **Summative assessment** • **Group discussion** (Search for information and calculate the time period of the planets in solar system).	

January		**D.1 : (HL Topics: 7 Hours)** • Gravitational potential in a uniform field I. Equipotentials and field lines • Gravitational potential due to a massive sphere I. Equipotential and potential wells II. Relationship between field lines and potential • Escape speed		• **Formative Assessment (Exercises)**	
January	**Topic B:The Particulate nature of matter**	**B.1 : Thermal energy transfers (SL)** • The Particulate model of matter • The three states of matter(Solid,Liquid,Gas) • Brownian motion • Density • Internal energy • Internal energy and the three states of matter • Temperature • Temperature and kinetic energy • Kelvin Scale • Temperature and	About **6 teaching** hours for **Topic B.1 Thermal energy transfers (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment:** 1.Exercises 2.Mind-map- **Reflect on the thermal energy and its transfer.**	

		molecular speed • Thermal energy and its transfer (Conduction, Convection,Radiation) • Black – body radiation I. The black body spectrum II. Wien's displacement law III. Inverse square law IV. Preventing heat loss • Thermal capacity • Specific heat capacity • Phase change • Specific latent heat • Graphical reperesentation of heat • Thermal energy loss			

February	**Topic A: space,time and motion**	**A.5 Galilean and special relativity** • Relative Velocity • Galilean transformations for length,velocity and acceleration • The nature of light I. The speed of light II. Momentum of light • Special relativity I. The two postulates of special relativity • Lorentz transformations • The muon experiment • Space – time interval II. Space –time diagrams	About **8 teaching** hours for **Topic A.5 Galilean and special relativity (HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment:** (Exercises)	

February/ March		**B.2 Greenhouse effect** • Radiation from the Sun • Interaction between solar radiation and atmosphere I. Ultraviolet radiation II. Visible light III. Infrared radiation • Radiation reaching the earth I. Interaction between light and solids II. Albedo III. Emissivity IV. The greenhouse effect • Energy balance I. Earth with atmosphere II. Earth without atmosphere • Global Warming I. Increase in solar constant II. Reduced albedo III. Reduced emissivity IV. Enhanced greenhouse effect	About **6 teaching** hours for **Topic B.2 Greenhouse effect (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment:** (Exercises) • **Formative assessment:** (Discussion on Global Warming)	

March		**B.3 Gas laws** • Avagadro's hypothesis • The mole and Avogadro's constant • The ideal gas I. Defining the state of gas II. Volume III. Temperature IV. Pressure V. Relationship between P,V,T and n • The Boyle- Mariotte law • Gay-Lussac's law • Charles' Law • The ideal gas equation • Internal energy of a gas	About **6 teaching** hours for **Topic B.3 Gas laws (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment:** (Exercises)	

March/ April	**Topic C: Wave behavior**	**C.1 Simple harmonic motion (SL/HL)** **<u>SL Topics: 3 Hours</u>** • The simple pendulum • Simple harmonic motion • SHM and the sine function • Terms and quantities • Mass on a spring • Graphical representation of SHM • Finding the frequencies of a pendulum and mass on a spring • Energy transfers during SHM • Phase **<u>HL Topics: 4 Hours</u>** • Problems using the equations for simple harmonic motion • Phase angle	About **7 teaching** hours for **Topic C.1 Simple harmonic motion (SL/HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment:** (Experiment report**) The relationship between time periodand length of a pendulum.** • **Formative assessment:** (Exercises)	

April		**C.2 Wave model:** • Waves I. Reflection II. Refraction III. Interference IV. Diffraction V. Transfer of energy • Wave pulse in a string I. Reflection of a wave pulse II. Superposition of wave pulses III. Continuous wave in a string (transverse wave) • Graphical representation of a transverse wave • Graphical representation of a longitudinal wave • Properties of sound waves • The electromagnetic spectrum • Some Light facts	About **3 teaching** hours for **Topic C.2 Wave model (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment (Exercises)**	

April/ May	**Topic B :The Particulate nature of matter**	**B.4 Thermodynamics (HL)** • Thermodynamic systems I. Workdone by a gas • The first law of thermodynamics I. Using P-V diagrams • Constant pressure compression(isobaric) I. Constant volume increase in temperature II. Isothermal expansion III. Adiabatic expansion • Cyclic processes I. Energy flow diagram II. The carnot cycle III. The reverse cycle • The second law of thermodynamics I. Entropy **IA – Data Collection and Revision for Summative**	About **8 teaching** hours for **Topic B.4 Thermodynamics (HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment (Exercises)** • **Summative Assessment**	

Year 2 July July/August	**Topic C: Wave behavior**	**C.3 Wave Phenomena :** **SL Topics: 5 Hours** • Wavefronts I. Wave propagation (Hugen's construction) • Reflection of water waves • Refraction of water waves I. Snell's law • Diffraction of water waves • Interference of water waves I. Path difference and phase difference • Reflection of light • Refraction of light • Dispersion I. The critical angle II. Total internal reflection III. Optical fibers • Interference of light I. Two – slit interference **HL Topics :6 Hours** • Diffraction of light at a single slit I. The central maximum II. The first	About **11 teaching** hours for **Topic C.3 Wave Phenomena (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment** 1. Laboratory activity Measuring the refractive index. 2. Exercises	

August		minimum • Effect of diffraction • Multiple –slit diffraction • Diffraction at the slits • Interference between slits • Geometrical model • Producing spectra **C4:Standing waves and resonance** • Standing waves in strings • Difference between progressive waves and standing waves • Stringed instruments • Standing waves in closed pipes • Standing waves in open pipes • Wind instruments • Damped harmonic motion • Forced vibration • Resonance	About **4 teaching** hours for **Topic C.4 Standing Waves and resonance (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment** (Exercises) Soving problems involving the frequency of a harmonic, length of the standing wave, and the speed of thewave.	
September		**C5:Doppler effect** **SL Topics : 2 Hours** • The Doppler effect • The Doppler effect and electromagnetic radiation • The expanding universe • Hubble's Law **HL Topics: 2 Hours** • The same extreme diference between the	About **4 teaching** hours for **Topic C.5 Doppler Effect (SL/HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment (Exercises)** • **Formative assessment (Exercises)**	

September/ October		speed of the wave and the relative speed of its observers and sources is less likely for sound or mechanical waves , so alternative equations are needed for quantitative evaluation. • Worked examples **B.5 : Current and circuits:** • Simple circuits I. Resistance II. Resistivity • Ohm's Law • Electric cells and batteries I. Internal resistance II. Emf and terminal potential difference III. Discharge of a cell • Generators I. Photovoltaic cell • Simplest circuit • Electrical power • Combination of components I. Resistors in series II. Resistors in parallel III. Cells in series IV. Cells in parallel	About **6 teaching** hours for **Topic B.5 Current and circuits (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment (Exercises)**	

October/ November	**Topic D : Fields**	V. • Electrical measurement I. Measurement of potential difference II. Measurement of current III. Variable resistors IV. Light dependent resistor V. Thermistor **<u>D.2 : Electric and magnetic fields</u>** **<u>SL Topics: 8 Hours</u>** • Electric force • Charge transfer by contact • Charge ,Q I. Fundamental charge,e II. Millikan's oil drop experiment • Electric field I. Field strength,E II. Field Lines • Coulomb's law I. Potential in a uniform field II. Earthing III. Charging by induction IV. Conductors	About **14 teaching** hours for **Topic D.2 Electric and magnetic fields (SL/HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment (Exercises)**	

November December		and current • Magnetic fields I. Magnetic field lines • Field caused by currents I. Magnetic flux density,B II. The field inside a coil III. The field inside a solenoid **HL Topics :6 Hours** • Electric field and energy • Potential ,V • Dipoles • Potential difference **D.3 : Motion in electromagnetic fields :** • Force on a current – carrying conductor I. Tesla • Parallel current – carrying conductor I. Parallel wires II. Non-perpendicular fields • Charges in magnetic fields I. The electron gun II. Motion of electrons in a uniform electric field III. Motion of	About **6 teaching** hours for **Topic D.3 Motion in electromagnetic fields (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment (Exercises)** • **Formative assessment (Exercises)** • **Summative Assessment**	

January		electrons in uniform magnetic field IV. Electrons in perpendicularly oriented electric and magnetic fields **D.4 : Induction (HL)** • Conductor moving in a magnetic field I. Induced emf II. Induced current III. Calculating induced emf • Faraday's law I. Rate of change of flux • Len's law I. Coils in changing magnetic fields II. Coil in a changing field III. Coil entering and leaving a magnetic field IV. Coil rotating in a uniform magnetic field V. The size of the emf induced in a rotating coil VI. Effect of increasing angular	About **6 teaching** hours for **Topic D.4 Induction (HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	• **Formative assessment (Exercises)**	

		velocity VII. Self - induction			

January/ February	**Topic E:Nuclear and Quantum Physics**	**E.1 Structure of the atom:** **SL TOPICS : 6 Hours** • The arrangement of charge in the atom • The Rutherford model • Charge and mass • Electrons • The connection between atoms and light • The quantum nature of light **HL TOPICS : 3 Hours** • Size of the nucleus • The Bohr model	About **9 teaching** hours for **Topic E.1 Structure of the atom (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	**Formative assessment (Exercises)**	

February		**<u>E.2 Quantum Physics: (HL)</u>** • The Quantum nature of light I. The photoelectric effect II. The Zinc plate experiment III. Quantum model of light IV. Millikan's photoelectric experiment V. Einstein's photoelectric equation • The wave nature of matter I. Detecting electrons II. Electron diffraction III. The de Broglie hypothesis IV. Probability waves • The Compton effect	About **8 teaching** hours for **Topic E.2 Quantum Physics (HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	**Formative assessment (Exercises)**	

March		**E.3 Radioactive decay: (SL/HL)** **SL TOPICS : 7 Hours** • The nuclear force • Binding enegy • Radioactive decay • Alpha decay • Beta decay (Minus,Plus) • Gamma radiation • Decay • Exponential decay of radioactive isotopes • Half life • Count rate • Background radiation • Applications of radioactive isotopes **HL TOPICS :5 Hours** • The strong nuclear force • Nuclear energy levels • Beta particles (NOS) • Foam decay curve equation • Exponential decay of radioactive isotopes • Relationship between decay constant and half –life • Worked example	About **12 teaching** hours for **Topic E.3 Radioactive decay (SL/HL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	**Formative assessment (Exercises)** **Formative assessment (Exercises)**	

April		**E.4 Fission: (SL)** • Nuclear fission • Nuclear power • The chain reaction • Moderation • Critical mass • The nuclear power station • Meltdown • Low level waste • High level waste **E.5 Fusion and stars :(SL)** • Nuclear fusion • Astronomical distances • Stellar parallax • EM radiation from stars • Apparent brightness • Luminosity • Stellar spectra • Absorption lines • Colours of stars • Hertzsprung-Russell (HR) diagrams • Main sequence • Red giants • Supergiants • White dwarfs • Variable stars • The birth of a star • Sun-sized stars • Large stars	About **4 teaching** hours for **Topic E.4 Fission (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers** About **6 teaching** hours for **Topic E.5 Fusion and stars (SL)** **Skills:** ✧ **Thinking skills** ✧ **Research skills** **LPA:** ✧ **Caring** ✧ **Risk takers**	**Formative assessment (Exercises)** **Formative assessment (Exercises)**	

2. The group 4 project

As the IB guides say, “The group 4 project is a collaborative activity where students from different group 4 subjects work together on a scientific or technological topic, allowing for concepts and perceptions from across the disciplines to be shared in line with aim 10—that is, to ‘encourage an understanding of the relationships between scientific disciplines and the overarching nature of the scientific method.’” Describe how you will organize this activity. Indicate the timeline and subjects involved, if applicable.

1. Selecting a topic
   To increase the students’ enthusiasm, I think the topic of the group 4 project should be selected by students themselves. And the teachers could give advice on the viability or provide several topics for the students. As the group 4 project is an interdisciplinary activity, I prefer to give topic such as “*Investigating the environmental impact of different types of renewable energy sources focusing on the concept sustainability”* which has close relationship with other subjects.
2. Subjects involved
   Students from physics, chemistry, and biology generally participate in the Group 4 project in IB DP Physics.
3. Timeline
   It is necessary to ensure that the students have sufficient knowledge and enough time to complete the subject. I will start the group 4 project in year 1 and finish it in year 2.
   (1) Planning (2 hours)
   At the end of year 1, the students will select topics, which is also part of the planning stage. Through helpful discussion and careful selection, the group 4 students can get a preliminary judgment of the topic. Then they will discuss the central topic and share ideas and information at the planning stage.
   (2) Action (6 hours)
   In the middle of year 2, it will take about two weeks in normal scheduled class time for the students to take action of the group 4 project.
   (3) Evaluation (2 hours)
   After the students finish the action stage, I will give them some time to organize their materials and results. Before the end of year 2, they will do the final presentations to evaluate their whole processes.

3. IB practical work and the internal assessment requirement to be completed during the course

As you know, students should undergo practical work related to the syllabus.

- Physics, chemistry and biology: 40 hours (at standard level) or 60 hours (at higher level)
- Computer science: 40 hours (at standard level) or 40 hours (at higher level)
- Design technology: 60 hours (at standard level) or 96 hours (at higher level)
- Sport, exercise and health science: 40 hours (at standard level) or 60 hours (at higher level)

Use the table below to indicate the name of the experiment you would propose for the different topics in the syllabus.

An example is given. Add as many rows as necessary.

Name of the topic	Experiment	Any ICT used? *Remember you must use all five within your programme.*
Acids and bases	Titration	Yes
A.1 Kinematics	Determining the acceleration of free-fall	yes
B.1 Thermal energy transfers	Applying the calorimetric techniques of specific heat capacity or specific latent heat	No
B.3 Gas Laws	Investigating at least one gas law	Yes
C.2 Wave model	Investigating the speed of sound	Yes
C.3 Wave Phenomena	Determining refractive index	Yes
B.5 Current and circuits	Investigating one or more of the factors that affect resistance	No
B.5 Current and circuits	Determining internal resistance	No
E.3 Radioactive decay	Investigating half-life	Yes
C.3 Wave Phenomena	Investigating Young's double-slit (HL only)	No

C.3 Wave phenomena	Single-slit diffraction	No
D.3 Motion in Electromagnetic fields	Force on a current-carrying conductor	No
B.5 Currents and circuits	Measuring of potential difference and current	No
D.4 Induction	Lenz’s law	No

4. Laboratory facilities

Describe the laboratory and indicate whether it is presently equipped to facilitate the practical work that you have indicated in the chart above. If it is not, indicate the timeline to achieve this objective and describe the safety measures that are applicable.

The physics laboratory includes the mechanical, electrical, optical and thermal equipment to meet the needs of the above topics, the group 4 project and the internal assessment.

Hands-on experiences are essential to learning in science classes, but safety must be the first concern. We have made the laboratory assistant handbook to clarify the laboratory policy and safety rules. The laboratory safety measures include the electric shock prevention measures and the fire prevention measures.

Electric shock prevention measures

(1) The electric wire cross-sectional area and fuse adoption in the experiment power supply circuit should match the standards of safe power supply. Power supply circuit requires periodic inspection and replacement. When installing electrical equipment, current and voltage should match the nominal value of the electrical equipment. In normal situations, using electrical appliances should have ground wire (unless with special instructions), and ground wire should be regularly checked to make sure it is working well.

(2) Install a main switchboard and leakage protector. Disconnect the main supply when leave the lab. Teacher should strictly control the students experimental electricity, and use as far as possible under 36 v safety voltage.

(3) Maintain the power cords and electrical appliances. Cut off power supply when cleaning. Do not wet the power cord and do not touch working electrical equipment with wet hands. Fix all electric wires and the cover of electrical boxes on time to avoid casualty caused by high voltage wire exposure.

(4) All electrical tools should have a good insulation handle. All electrical appliances should be connected with a grounding line.

Fire prevention measures

(5) When using electric heaters such as electric soldering irons and electric stoves, they should not be put on combustible materials. When users leave, power supply should be cut off.

(6) Inflammable and explosive chemical drugs should be stored strictly in accordance with regulations. When a large amount of alcohol or gasoline spilled on the ground, immediately open a window to ventilate the room. Indoor open flame is strictly prohibited. Gas should not be used to replace kerosene and alcohol for fuel.

5. Other resources

Indicate what other resources the school has to support the implementation of the subject and what plans there are to improve them, if needed.

The school has purchased reference books for the students to look up, and will buy more reference books based on interest of the students. When the students are planning for the group 4 project and preparing the internal assessment, the library will provide access to the needed database.

6. Links to TOK

You are expected to explore links between the topics of your subject and TOK. As an example of how you would do this, choose one topic from your course outline that would allow your students to make links with TOK. Describe how you would plan the lesson.

Topic	Link with TOK (including description of lesson plan)
D.2 Electric and magnetic fields	Link with TOK : A discussion about 'empirical versus theoretical models' Open Question: How do cultural beliefs and values influence the way we approach empirical concepts of magnetism, such as the use of magnets in traditional medicine or spirituality?How it is related with theoretical concepts. **Empitical concepts:** Students are motivated to gather information such as the way we perceive empirical ideas of magnetism, such as the usage of magnets in traditional medicine or spirituality, can be significantly influenced by cultural beliefs and values. Magnets have been utilised for centuries to cure a wide range of diseases and disorders in many different civilizations. For instance, magnets are said to balance the body's energy and encourage healing in traditional Chinese medicine. Magnets are employed in healing rituals and are said to have spiritual power in some Native American societies. **Theoritical Concepts:** However, there may be instances where scientific proof or empirical data do not support the use of magnets in conventional medicine or spirituality. Here, theoretical notions of magnetism, such as the fundamentals of electromagnetic or quantum physics, can be employed to either support or contradict these assertions. For instance, the use of magnets in medical treatment may have advantages or disadvantages that can be determined by understanding how magnetic fields are produced and interact with the body. The students will use critical thinking in this topic.

7. Approaches to learning

Every IB course should contribute to the development of students' approaches to learning skills. As an example of how you would do this, choose one topic from your outline that would allow your students to specifically develop one or more of these skill categories (thinking, communication, social, self-management or research).

Topic	Contribution to the development of students' approaches to learning skills (including one or more skill category)
Skills in the study of physics (Measurement in physics) Current and circuits	**<u>Activity: Deciding on what is fundamental</u>:** ✧ **ATL: Research→Information literacy skills;** **Communication →Communication skills** ■ Inquiry question: Who has made the decision that the fundamental quantities are those of mass, length, time, electrical current, temperature, luminous intensity, and amount of substance? ■ The students will searching the related information on the internet and share their findings with the other students in class. **Scientific notation** 3. **ATL : Thinking→Transfer skills** (Make connections between subject group and disciplines) **Link : mathematics** ■ **Relationships** in mathematics concerns the way that things connect together. ■ **Standard notation** is used to help us represent size. **Understand and use technology systems – Envoy (ATT)** 4. **ATL : Research→Information literacy skills** (Understand and use technology systems) For example, if the class is learning about types of circuits, the teacher could assign the following roles to students: **Captain of the Series Circuit**: This student would be in charge of explaining series circuits and demonstrating how they work. **Parallel Circuit Prodigy**: This student would be in charge of explaining and demonstrating the concept of parallel circuits. **Circuit Analyzer:** This student would be in charge of analysing various types of circuits and determining whether they were series or parallel.

	Circuit Builder: This student would be in charge of building various types of circuits and testing their functionality. **Circuit Troubleshooter**: This student is in charge of identifying and resolving issues that arise when circuits fail to function properly. Each student would be responsible for completing their assigned tasks and assisting their classmates in understanding the concepts related to their specific topic throughout the week. Additionally, this activity can help students better understand the different types of circuits and how they function.

8. International mindedness

Every IB course should contribute to the development of international-mindedness in students. As an example of how you would do this, choose one topic from your outline that would allow your students to analyse it from different cultural perspectives. Briefly explain the reason for your choice and what resources you will use to achieve this goal.

Topic	Contribution to the development of international mindedness (including resources you will use)
E.4 Fission	• To begin with, the study of nuclear fission and its uses has worldwide importance because it is a technology that may be utilized both peacefully and militarily. As a result, individuals must approach the study of fission from a global viewpoint, recognizing the possible benefits and threats of this technology for people all over the world. • Understanding the worldwide legislation and agreements controlling the use of nuclear energy, as well as the various viewpoints and priorities of different countries, is part of this. • We can ensure that the benefits of fission are shared fairly and equitably around the world by approaching the research of fission with a global perspective, addressing the ethical and social implications of this technology, and participating in discourse and collaboration with varied stakeholders. **Resaon for choice:** • The students will have a deeper understanding of the influences of the nuclear weapons, and think about the attitudes of different countries to nuclear weapons and the reasons behind them to help the students develop their internationalmildedness. Because the aim of all IB programmes is to develop internationally minded people who devote to create a better and more peaceful world. • **Resources:** **Nuclear Energy Institute**: https://www.nei.org/home **International Atomic Energy Agency :** https://www.iaea.org/ **Department of Energy: https://www.energy.gov/** **Nuclear Regulatory Commission: https://www.nrc.gov/about-nrc.html** **MIT OpenCourseWare: https://www.mygreatlearning.com/mit-idss-data-science-and-machine-learning-program?&utm_source=Google&utm_medium=search&utm_campaign=MIT_DSML_Brand_Search_MIT&adgroup_id=140058738848&campaign_id=16549043508&keyword=mit%20online%20courses&placement=&ad_id=587438514674&gclid=Cj0KCQjwi46iBhDyARIsAE3nVrZsqC9ZWP8WZh_2n_U1QZW0aWUBgliyf4JuBT9iJvda8NcFc5bF4kEaAslhEALw_wcB**

9. Development of the IB learner profile

Through the course it is also expected that students will develop the attributes of the IB learner profile. As an example of how you would do this, choose one topic from your course outline and explain how the contents and related skills would pursue the development of any attribute(s) of the IB learner profile that you will identify.

Topic	Contribution to the development of the attribute(s) of the IB learner profile
A.2 Force and Momentum	**Communicators :** **<u>Example Topic in Physics:</u>** **"Friction is more important than gravity in determining the motion of an object."** 1. This can be done by Class debate activities can be very effective in improving students' critical thinking, public speaking, and communication skills. 2. It can also encourage students to conduct research and gather data to back up their claims, thereby improving their research skills. 3. Debate activities can also expose students to various points of view and worldviews, broadening their understanding of issues and increasing empathy for others. 4. They can also encourage healthy debate and discourse among students, as well as improve their ability to handle disagreements and conflicts constructively.