# SCIENCE

## Grade 9

### Three-Term Budget Of Work (BOW) for Learning Competencies

# SCIENCE
# GRADE 9

## Three-Term Budget Of Work
## For Learning Competencies

| First Term | |
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| **Content Standard** | • Newton's laws explain and predict how objects move due to the forces that act on them.<br>• Electricity is a flow of electrons and can be measured and understood using current, voltage, and resistance in circuits.<br>• Electromagnetic radiation travels using transverse waves of different wavelengths.<br>• Scientists and engineers use electromagnetic radiation to design modern technologies that benefit people and society.<br>• Evidence for continents moving includes jig-saw matching of coastlines, rock types, and the presence of similar fossils in places separated by vast distance.<br>• The movement of lithospheric plates provides a theory for understanding Earth's geological history. |
| **Performance Standard** | By the end of the term, learners demonstrate a practical understanding of Newton's three laws of motion to describe relationships between variables and use these to explain everyday application of Newton's laws. Through practical investigations, learners demonstrate qualitative understanding of the features of electricity and apply their understanding of electrical circuitry in homes. Learners exhibit skills in gathering information from secondary sources to describe the frequencies across the electromagnetic spectrum and identify practical applications and detrimental effects that electromagnetic radiation may have on living things. Also, learners exhibit skills in evaluating information from secondary sources, and draw on their scientific understanding of the location and geological setting of the Philippines to explain its unique landforms and dynamic geologic |

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| | activity in a global context. |

| Week | Learning Competency |
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| **1 to 2** | **Newton's Laws, Force, and Energy**<br>• Identify inertia as the tendency for an object to stay at rest or in motion unless acted on by an unbalanced net force.<br>• Demonstrate in practical situations and describe that acceleration is a change in speed and/or direction as the result of a net force.<br>• Investigate the relationship among force, acceleration, and mass.<br>• Explain that when any two objects interact, there are equal but opposite forces exerted between them, which is evident in many practical situations and applications.<br>• Observe and identify action-reaction pairs in everyday situations such as stepping off a boat, or a book on a table, and draw force diagrams to explain how the pairs affect the motion of objects. |
| **3 to 8** | **Electric Current, Electrical Circuits, Interpreting Patterns in Data, and Electromagnetic Waves**<br>• Identify that electricity is a flow of electrons and show appreciation for the need to observe safe measures in handling electricity.<br>• Participate in guided investigations to infer the relationship among current, voltage, and resistance in assembled series and parallel circuits with varying number of loads and battery.<br>• Draw diagrams of and assemble series and parallel circuits, showing switch, battery, loads/resistors, ammeter, and voltmeter.<br>• Collaborate in a class discussion to recognize the advantages and limitations of using series or parallel circuits.<br>• Describe electromagnetic radiation (EMR) as energy that is created by the vibrations of electrically charged particles which allows it to travel through materials or space as transverse waves.<br>• Compare the relative wavelengths and frequencies of different types of electromagnetic waves, including radio waves, microwaves, infrared, visible light, ultra-violet, x-rays, and gamma radiation.<br>• Identify practical applications of electromagnetic radiation, such as radio waves used in telecommunications, and x-rays and gamma rays in medicine.<br>• Gather information from secondary sources to explain the harmful effects that EMR can have on living things. |

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| **9 to 11** | **Plate Boundaries**<br>• Identify and explain evidence that current continents are separate parts of what was a single continent millions of years ago.<br>• Participate in a collaborative group or class task to examine and describe the topographical and geological evidence for plate boundaries occurring in the area where the Philippines is located.<br>• Describe the types of plate boundaries found around the Earth. |
| **Suggested Activities** | • **Inertia at Home Investigation** – Learners test inertia using common objects (coin-on-card over a glass, book-and-paper pull, toy car on a smooth surface), then describe what changed the motion and what stayed the same.<br>• **Acceleration and Net Force Push-Pull Lab** – Learners use improvised carts (toy car, bottle on cardboard, or small box) and apply different pushes/pulls to observe changes in speed and direction; learners record observations using a simple motion table.<br>• **Force–Mass–Acceleration Relationship Ramp Investigation** – Learners roll the same object down a ramp with different masses (adding coins/clay) or apply the same pull with different masses (rubber band pull) to observe how mass affects acceleration; record and compare results.<br>• **Action–Reaction Pairs Community Observation Walk** – Learners identify action–reaction pairs in familiar Philippine settings (stepping off a bangka, pushing a tricycle, jumping on the ground, book on a table) and create force diagrams for each scenario.<br>• **Force Diagram Clinic Using Real Situations** – Learners practice drawing force diagrams for objects at rest and in motion (hanging bag, jeepney slowing down, bicycle moving, box being pushed), focusing only on forces that act on the object.<br>• **EMR as Transverse Waves Rope-and-Slinky Modeling** – Learners use a rope or slinky to model transverse waves (crest, trough, wavelength, frequency) and connect the model to how electromagnetic radiation travels as transverse waves.<br>• **EM Spectrum Ordering with Frequency–Wavelength Strip Activity** – Learners arrange EM wave cards (radio to gamma) and use a simple ruler-scale strip to compare relative wavelength and frequency; include local examples (cellphone |

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| | signal, Wi-Fi, microwave oven, TV remote IR, sunlight/UV).<br>• **EMR Applications in Philippine Life Research Mini-Task** – Learners gather secondary-source information on EMR applications common in the Philippines (telecommunications, radio/TV, medical x-ray, UV disinfection) and summarize how each benefits people.<br>• **Harmful Effects of EMR Evidence Brief** – Learners use secondary sources to explain harmful effects of EMR (UV and skin/eye damage, excessive exposure risks, improper x-ray exposure), linking effects to human activities and safety practices in daily life.<br>• **Continental Drift Evidence Jigsaw Puzzle Lab** – Learners do a "jigsaw" matching activity using coastline pieces, rock-type strips, and fossil distribution cards to explain why continents were once joined; include Philippine/Asian region reference maps where available.<br>• **Philippine Plate Boundary Evidence Map Task** – Learners examine PH-focused maps (trenches, faults, volcano belts, earthquake distribution) and describe what topographical and geological patterns suggest about plate boundaries near the Philippines.<br>• **Plate Boundary Types Model Lab** – Learners model divergent, convergent, and transform boundaries using cardboard/foam/paper strips and record the structures/events produced (ridges, trenches, mountains, faults, earthquakes). |
| **Suggested Performance Tasks** | • **Action–Reaction Rescue Vehicle Model** – Design and build a model vehicle that is propelled by action–reaction forces and requires an understanding of how forces influence the motion of the vehicle.<br>• **Philippine Electricity Generation and Distribution System Model** – Design and build a working model, schematic diagram, or a full poster representing the electricity generation and distribution system in the Philippines.<br>• **Electromagnetic Spectrum Media Poster** – Design and build a media/technology poster depicting the uses, benefits, and harmful effects of different electromagnetic waves. |

| Second Term | |
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| **Content Standard** | • The geological time scale organizes major stages in the history of the Earth over more than 4 billion years.<br>• Radioactive decay of material inside the Earth since it was formed is its internal source of energy.<br>• The Earth's interior is made up of layers of varying characteristics.<br>• Models represent the size, structure, and relationship of components of the Solar System.<br>• Observable evidence and models help explain the nature and origin of the Solar System.<br>• High biodiversity means populations are more likely to overcome adverse conditions.<br>• Human activities can adversely affect animals and plants in a variety of ecosystems. |
| **Performance Standard** | By the end of the term, learners demonstrate an appreciation of the size and scale of the Earth and describe evidence for a dynamic Earth over its long geological history as well as the evidence that is used to build a model for the internal structure of the Earth. Learners demonstrate curiosity and open-mindedness in extending their knowledge and understanding of the dynamic Earth to evaluate evidence for theories for the formation of the Solar System. They describe modern scientific processes and technologies that are used by scientists to investigate the nature and evolution of the Solar System and Universe. They also explain that high levels of diversity help to maintain stability of an ecosystem. They research to classify critically endangered plants and animals of the Philippines and to identify strategies to protect and conserve them. They use drawings and diagrams to describe features of typical Philippine ecosystems and they conduct a survey to explore possibilities to minimize the impact of human activities. |
| **Week** | **Learning Competency** |
| **1 to 4** | **Scale, Proportion, and Quantity, Structure of the Earth, and Geologic Time** |

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| | • Describe how fossils can be used for dating the age of rocks and sediments.<br>• Describe how relative and absolute dating techniques are used to determine the subdivisions of geologic time.<br>• Explain how the geologic time scale helps to recount the history of the Earth.<br>• Describe how seismic wave data has been used to develop a model for the internal structure and composition of the Earth.<br>• Create a scale drawing to represent relative thicknesses of the layers of Earth's interior, including the crust, lithosphere, asthenosphere, mantle, outer core, and inner core. |
| **5 to 6** | **Origin of the Solar System**<br>• Distinguish among comets, meteoroids, asteroids, and dwarf planets, and describe how they help us to understand the nature and formation of the Earth and the Solar System.<br>• Gather information from secondary sources to discuss the regular occurrence of meteor showers. |
| **7** | **Space Technologies**<br>• Explain how modern research about celestial objects uses new space technologies including telescopes and space probes. |
| **8 to 10** | **Biodiversity and Endangered Species**<br>• Explain the advantage of high biodiversity in maintaining the stability of an ecosystem during difficult conditions, such as food shortages, disease, and climate change.<br>• Use information from secondary resources to classify animals and plants of the Philippines as critically endangered, endangered, or vulnerable species.<br>• Discuss as a class how threats to biodiversity can lead to species extinction.<br>• Use information from secondary sources to research how to protect and conserve endangered and/or economically important species in the local community. |
| **10 to 11** | **Types of Ecosystems in the Philippines**<br>• Describe using labeled diagrams the biotic and abiotic features of tropical rainforests, swamps, estuaries, mangrove forests, and coral reefs.<br>• Use information from secondary sources to describe the possible effects of human activities, such |

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| | as deforestation, pollution, and introduction of invasive species, on living things in an ecosystem.<br>• Plan to conduct a survey to explore the possibilities for minimizing the negative impacts of human activities on an ecosystem. |
| **Suggested Activities** | • **Philippine Biodiversity Classification Task** – Learners use secondary sources to classify selected Philippine species as critically endangered, endangered, or vulnerable and identify threats affecting each.<br>• **Biodiversity Stability Modeling Activity** – Learners model how higher biodiversity can increase ecosystem stability using a simple "food web balance" card model under stress scenarios (disease, food shortage, climate events).<br>• **Local Conservation Action Plan Mini-Research** – Learners research how to protect and conserve endangered and/or economically important species in their locality and write a practical, community-level action list.<br>• **Fossil Dating Simulation Using Stratigraphy Cards** – Learners use "layer cards" with fossils to infer relative ages of rocks and explain how fossils help date sediments and rock layers.<br>• **Relative vs Absolute Dating Classroom Investigation** – Learners compare two mock datasets: stratigraphic layers (relative dating) and simplified radioactive decay results (absolute dating) to explain how geologic time subdivisions are determined.<br>• **Geologic Time Scale Timeline Build** – Learners construct a scaled classroom timeline (string or paper strip) to represent major divisions of geologic time and place key events (fossils, major transitions) to show how the time scale recounts Earth's history.<br>• **Seismic Wave Evidence Lab (S- and P-wave Data)** – Learners analyze simplified seismogram/travel-time data to infer Earth's internal layers and explain how seismic waves helped develop the Earth structure model.<br>• **Earth Layers Scale Drawing Activity** – Learners create a scale drawing showing relative thicknesses of Earth's layers (crust, lithosphere, asthenosphere, mantle, outer core, inner core) using provided thickness values and a chosen scale. |

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| **Suggested Performance Tasks** | • **Space Technologies and Data Collection Report** – Produce a report on space technologies (telescopes, probes) and explain their use in collecting data that contributes to our understanding of the Solar System.<br>• **Environmental Action Group Report** – Write a report on an environmental action group and their impact on the biosphere and environments.<br>• **Philippine Ecosystem Biodiversity Research Project** – Conduct a research project on a specific Philippine ecosystem and explain the advantages of high biodiversity in maintaining the stability of that ecosystem.<br>• **3D Earth Features Model** – Design and build a 3D model of the features of the Earth. |

| Third Term | |
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| **Content Standard** | • Transmission of traits is determined by DNA, genes, and chromosomes.<br>• High biodiversity means populations are more likely to overcome adverse conditions.<br>• Human activities can adversely affect animals and plants in a variety of ecosystems.<br>• Valid and reliable scientific investigations include identification and control of variables.<br>• Formation or breaking down of ionic or covalent bonds results in a chemical change.<br>• Bonds are formed between atoms either by sharing or transferring of electrons.<br>• The type of bond formed determines whether the result is a covalent or ionic compound.<br>• Symbols for the elements are used as a basis for writing chemical formula of compounds.<br>• The properties of pure substances depend on the type of bonding within them |
| **Performance Standard** | By the end of the term, learners describe that the transmission of traits is determined by DNA, genes, and chromosomes. Learners also carry out a valid and reliable scientific investigation showing the formation of a new substance. They demonstrate an understanding of the significance of the valence electron of an element in the formation of bonds and identify bonds as ionic, covalent, or metallic. They use their knowledge of the symbols of elements to write the formula for a number of common compounds. They draw models of possible structures of ionic compounds and research the properties of ionic, covalent, and metallic substances. They use cartoons/comic strips to create interesting learning tools. |
| **Week** | **Learning Competency** |
| **1 to 3** | **DNA Replication and Mutations**<br>• Use models and labeled diagrams to represent the double helix structure of DNA (deoxyribonucleic acid). |

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| | • Explain the role of DNA, genes, and chromosomes in the transmission of traits.<br>• Describe mutations as changes in DNA or chromosomes and discuss some of the factors that cause mutations, such as infectious agents, radiation, and chemicals.<br>• Use information from secondary sources to explain the beneficial, harmful, and neutral effects of mutations. |
| **4 to 6** | **Valid and Reliable Investigations: Chemical Bonding**<br>• Carry out a valid and reliable scientific investigation to show the formation of a new substance, such as formation of a carbonate (carbon dioxide in limewater), or formation of a precipitate (from silver nitrate solution).<br>• Explain that the formation of new bonds or the breaking of existing bonds constitutes a chemical change and the formation of a new substance.<br>• Describe a valence electron as an electron in the outer shell of an atom that can take part in formation of bonds. |
| **7 to 9** | **Chemical Bonding: Ionic Compounds and Covalent Compounds**<br>• Identify the number of valence electrons of oxygen based on its position in the periodic table.<br>• Explain the formation of ions as either the loss or gain of electrons to produce ionic bonds, using examples, such as the formation of sodium chloride.<br>• Write the chemical formula and chemical names of some common ionic compounds, including sodium chloride (NaCl), magnesium oxide (MgO), potassium chloride (KCl) and magnesium chloride (MgCl2).<br>• Explain the formation of covalent bonds using a molecule of water and a molecule of carbon dioxide.<br>• Write the chemical formula and chemical name of some common covalent compounds, including water (H2O), carbon dioxide (CO2), and ammonia (NH3).<br>• show by using models that ionic compounds form crystalline structures whereas covalent compounds form individual molecules. |
| **10** | **Chemical Bonding: Metallic Bonds**<br>• Explain properties of metals in terms of their structure and metallic bonding (sea of electrons |

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| | model). |
| **11** | **Valid and Reliable Investigations and Chemical Bonding**<br>• Investigate the properties of ionic, covalent, and metallic substances, such as melting point, hardness, electrical and thermal conductivity. |
| **Suggested Activities** | • **DNA Double Helix Model Build** – Learners construct a DNA model using low-cost materials (paper strips, beads, clay) and label key parts (sugar-phosphate backbone, base pairs) with a guided template.<br>• **Genes–Chromosomes–Traits Simulation** – Learners use a simple trait-inheritance card model to explain how DNA, genes, and chromosomes work together to transmit traits.<br>• **Mutation Causes in Daily Life Evidence Task** – Learners classify mutation causes (radiation, chemicals, infectious agents) using Philippine-relevant examples (UV exposure, smoking, certain chemicals) and summarize how each can change DNA/chromosomes.<br>• **Mutation Effects Case Card Analysis** – Learners use secondary sources to categorize mutation effects (beneficial, harmful, neutral) using short case cards and explain why each falls in the category.<br>• **New Substance Formation Investigation (Precipitate or Carbonate Test)** – Learners carry out a guided investigation showing formation of a new substance (e.g., $CO_2$ turning limewater milky; precipitate formation using teacher-provided safe solutions), then describe observed evidence of chemical change.<br>• **Bond Breaking and Bond Forming Model Activity** – Learners use particle/bond models (paper clips, toothpicks, beads) to show that chemical change involves breaking existing bonds and forming new bonds.<br>• **Valence Electrons and Periodic Table Reasoning Task** – Learners use periodic table position to identify valence electrons (focused example: oxygen) and explain why valence electrons matter in bonding.<br>• **Ion Formation and Ionic Bond Modeling** – Learners model electron loss/gain using simple tokens to show ion formation and ionic bonding, using sodium chloride |

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| | as the core example.<br>• **Common Ionic Compounds Formula-and-Name Practice** – Learners practice writing formulas and names for NaCl, MgO, KCl, and $MgCl_2$ using an ion-charge guide, then check using a peer key.<br>• **Covalent Bond Formation Model ($H_2O$ and $CO_2$)** – Learners model sharing of electrons to form covalent bonds using water and carbon dioxide, then write correct formulas and names for $H_2O$, $CO_2$, and $NH_3$.<br>• **Crystalline vs Molecular Structure Model Comparison** – Learners build a "lattice" model for ionic compounds and a "separate molecules" model for covalent compounds to show structural differences.<br>• **Metallic Bonding 'Sea of Electrons' Demonstration Model** – Learners use a simple model to represent metal cations in a sea of electrons and connect this to conductivity and malleability.<br>• **Properties of Substances Investigation Lab** – Learners test and compare ionic, covalent, and metallic substances (teacher-provided) for hardness, conductivity (simple tester), and thermal response, then record patterns linking properties to bonding types. |
| **Suggested Performance Tasks** | • **Chemical Bonds Comic Strip** – Create a cartoon/comic strip describing ionic, covalent, and metallic bonds and how they are involved in the formation of compounds. |