SCIENCE

Structuring Competencies in a Definitive Budget of Work

Grade	**NINE**
Science Discipline/Component	**FORCE, MOTION AND ENERGY**
Grade Level Standard	At the end of Grade 9, learners have gained a a deeper understanding of the digestive, respiratory, and circulatory systems to promote overall health. They have become familiar with some technologies that introduce desired traits in economically important plants and animals. Learners can explain how new materials are formed when atoms are rearranged. They recognize that a wide variety of useful compounds may arise from such rearrangements. Learners can identify volcanoes and distinguish between active and inactive ones. They can explain how energy from volcanoes may be tapped for human use. They are familiar with climatic phenomena that occur on a global scale. They can explain why certain constellations can be seen only at certain times of the year. Learners can predict the outcomes of interactions among objects in real life applying the laws of conservation of energy and momentum.
Domain	**FORCE AND MOTION** To deepen their understanding of motion, learners use the Law of Conservation of Momentum to further explain the motion of objects. charts, and graphs) the motion of objects in one dimension. explain why objects move (or do not move) the way they do (as described in Grade 7). They also realize that if force is applied on a body, work can be done and may cause a change in the energy of the body. From motion in one dimension in the previous grades, they learn at this level about motion in two dimensions using projecti le motion as an example.
Performance Standard	The learners shall be able to propose ways to enhance sports related to projectile motion.
Content Standard	The learners demonstrate an understanding of projectile motion, impulse and momentum, and conservation of linear momentum.

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CONTENT	LEARNING COMPETENCIES	CODE	NO. OF DAY/S TAUGHT	REMARKS
1. Motion in Two Dimensions				
1.1. Projectile Motion	**1. Describe the horizontal and vertical motions of a projectile.**	**S9FE-IVa-34**		
	1.1 Describe the uniformly accelerated motion (horizontal and vertical) qualitatively	S9FE-Iva-34.1	1	
	1.2 Describe uniformly accelerated motion (horizontal and vertical) quantitatively	S9FE-Iva-34.2		
	1.3 Describe projectile motion qualitatively and quantitatively	S9FE-Iva-34.3	1	
	1.4 Label a diagram illustrating progjectile motion by indicating the range, height, trajectory, initial horizontal velocity, and initial vertical velocity.	S9FE-Iva-34.4		
	2. Investigate the relationship between the angle of release and the height and range of the projectile.	**S9FE-IVa-35**		
	2.1 Demonstrate what happens to the height and range of the projectile at different angles of release	S9FE-IVa-35.1	1	
	2.2 Infer from examples that the angle of release affects the height and range of a projectile	S9FE-IVa-35.2		

	2.3 Infer that complementary angles of release result in the same range but different height for a projectile	S9FE-IVa-35.3	1	
	2.4 Use examples derive from sports to show that the angle of release affects the range and height of a projectile	S9FE-IVa-35.4	1	
1.2. Impulse, Momentum and Impulse	**3. Relate impulse and momentum to collision of objects (e.g., vehicular collision).**	**S9FE-IVb-36**		
	3.1 Analyze the factors that affect momentum	S9FE-IVb-36.1	1	
	3.2 Distinguish between momentum and impulse	S9FE-IVb-36.2	1	
	3.3 Solve problems applying the concept of impulse and momentum	S9FE-IVb-36.3	1	
	3.4 Apply the concept of momentum and impulse to real life situations (e.g. Collisions)	S9FE-IVb-36.4	1	
1.3. Conservation of Linear Momentum	**4. Infer that the total momentum before and after collision is equal.**	**S9FE-IVc-37**		
	4.1 Apply the law of conservation of momentum to real life situations (interaction between a stationary body and a moving body)	S9FE-IVc-37.1	1	
	4.2 Apply the law of conservation of momentum to real life situations (interaction between two objects moving in the same and opposite directions)	S9FE-IVc-37.2	1	

	4.3 Appply the law of conservation momentum to real life situations (recoil interaction)	S9FE-IVc-37.3	1	
	4.4 Distinguish between elastic and inelastic collisions	S9FE-IVc-37.4	1	
	5. Examine effects and predict causes of collision related damages/injuries.	**S9FE-IVd-38**		
	5.1 Examine effects of collision related damages/injuries	S9FE-IVd-38.1	1	
	5.2 Predict causes of collision related damages/injuries	S9FE-IVd-38.2		
	Suggested Performance Task: Physics in Sports		1	
	In this suggested performance task, learners will research and report on different ways by which performance in sports can be enhanced through application of concepts in projectile motion and impulse and momentum.			
	Summative Assessment on S9FE-IVa-34, S9FE-IVa-35, S9FE-IV		1	
Domain	***ENERGY***			
	Learners explain how conservation of mechanical energy is applied in some structures, such as roller coasters, and in natural environments like waterfalls. The further describe the transformation of energy that takes place in hydroelectric power plants.			
Performance Standard	The learners shall be able to create a device that shows conservation of mechanical energy.			
Content Standard	The learners demonstrate an understanding of conservation of mechanical energy.			

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CONTENT	LEARNING COMPETENCIES	CODE	NO. OF DAYS TAUGHT	REMARKS
2. Work, Power, and Energy				
2.1 Changes in form of mechanical energy	**6. Explain energy transformation in various activities/events (e.g., waterfalls, archery, amusement rides).**	**S9FE-IVd-39**		
	6.1 Trace and explain the energy transformations in various activities.	S9FE-IVd-39.1	1	
	6.2 Differentiate KE from PE	S9FE-IVd-39.2	1	
2.2 Conservation of energy	**7. Perform activities to demonstrate conservation of mechanical energy.**	**S9FE-IVe-40**		
	7.1 Analyze the conversion potential to kinetic energy and vise versa to given situations (e.g. pendulum, roller coaster, ascending and descending the stairs)	S9FE-IVe-40.1	2	
	7.2 Perform experiment to demonstrate conservation of mechanical energy.	S9FE-IVe-40.2	2	
	8. Infer that the total mechanical energy remains the same during any process.	**S9FE-IVf-41**		
	8.1 State the Law of Conservaton of Mechanical Energy	S9FE-IVf-41.1	2	
	8.2 Calculate the potential / kinetic energy of an object using the law of	S9FE-IVf-41.2	2	
	Summative Assessment for S9FE-IVd-39, S9FE-IVe-40, and S9FE-IVf-41		1	

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Domain	***ENERGY***			
	Learners also learn about the relationship between heat and work, and apply this concept to explain how geothermal power plants operate.			
Performance Standard	The learners shall be able to analyze how power plants generate and transmit electrical energy.			
Content Standard	The learners demonstrate an understanding of the relationship among heat, work, and efficiency.			
CONTENT	**LEARNING COMPETENCIES**	**CODE**	**NO. OF DAY/S TAUGHT**	**REMARKS**
3. Heat, Work, and Efficiency				
	9. Construct a model to demonstrate that heat can do work.	**S9FE-IVg-42**		
	9.1 Explain how heat causes the internal energy of a system increase	S9FE-IVg-42.1	2	
	9.2. Demonstrate that heat can do work by constructing a model	S9FE-IVg-42.2	2	
	10.Infer that heat transfer can be used to do work, and that work involves the release of heat.	**S9FE-IVh-43**		
	10.1 Relate heat to work	S9FE-IVh-43.1	1	
	10.2 Explain how heat pumps (refrigerators and airconditioner) work.	S9FE-IVh-43.2	1	
	11. Explain why machines are never 100-percent efficient.	**S9FE-IVh-44**		
	11.1Perform an activity to verify that machines are never 100-percent efficient.	S9FE-IVh-44.1	1	
	11.2 Solve for the thermal efficiency of a machine	S9FE-IVh-44.2	1	

	12. Explain how heat transfer and energy transformation make heat engines like geothermal plants work.	**S9FE-IVi-45**		
	Explain how heat transfer and energy transformation make heat engines like geothermal plants work		1	
	Suggested Performance Task: Role-playing an Engineer's Job		1	
	In this suggested performance task, learners will analyze a given situation and take the role of an engineer in presenting a solution that will show how a power plant works.			
	Summative Assessment on S9FE-IVg-42, S9FE-IVh-43, S9FE-IVh-44, and S9FE-IVi-45		1	

Domain	***ENERGY***			
	After they have learn ed how electricity is generated in power plants, learners further develop their understanding of transmission of electricity from power stations to homes.			
Performance Standard	The learners shall be able to analyze how power plants generate and transmit electrical energy.			
Content Standard	The learners demonstrate an understanding of the generation, transmission, and distribution of electrical energy from power plants (hydroelectric, geothermal, wind, nuclear) to home.			
CONTENT	**LEARNING COMPETENCIES**	**CODE**	**NO. OF DAYS TAUGHT**	**REMARKS**
4. Electricity and magnetism				
4.1 Power generation and energy losses	**13. Explain how electrical energy is generated, transmitted, and distributed**	**S9FE-IVj-46**		

4.2 Transmission and distribution of electrical energy from power plants to homes	13.1 Trace the energy transformation in electrical power plants	S9FE-IVj-46.1	1	
	13.2 Explain how electrical energy reaches the consumer.	S9FE-IVj-46.2	1	
	13.3 Distinguish between electrical power generation, distribution and transmission.	S9FE-IVj-46.3	1	
	13.4 Differentiate a step-up from a step down transformer	S9FE-IVj-46.4	1	
	13.5 Cite ways to minimize power loss in generation, transmission, and distribution of electrical energy	S9FE-IVj-46.5	1	
		Fourth Quarter Summative Test	**2**	
		TOTAL	**45**	