PHENOMENA, DRIVING QUESTIONS AND SEPUP STORYLINE

CHEMICAL REACTIONS

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Unit Issue: The use of chemical reactions to solve problems.

Anchoring Phenomenon: Chemical reactions can be used to solve problems but can also create problems. Examples explored include combining certain substances releases a gas, combining certain substances releases energy (such thermal energy, light, electricity), and combining certain liquids results in a color change or formation of a solid. Students generate and answer questions such as: What happens when new materials are formed? How do particles combine into new substances? How can chemical reactions solve and create problems?

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	Storyline
Sometimes when we make a product, we get side products that we don't want.	What are the wastes from producing circuit boards, and is there anything we can do about them?	What happens when chemical processes are used to produce electronic devices? (Activity 1)	1 (12, 13)	Chemical reactions are used to produce desirable products (circuit boards), but they also lead to production of wastes (by-products) from chemical processes. (Substances can be identified by their properties and can't be made to just "go away.")
When you mix some substances, they do things like fizz, change color, disappear or change temperature.	What is happening when substances appear to change?	How can you tell if a chemical change has occurred? (Activity 2)	2, 3, 5	Four common signs may frequently indicate that chemical reactions have taken place.
		What is the difference between a physical and a chemical change? (Activity 3)		Careful observation of properties is needed to distinguish physical and chemical changes. These macroscopic changes can be explained by what is happening at the level of atoms and molecules.
		Is the phenomenon observed a physical change or a chemical change (reaction)? (Activity 5)		In this activity, students apply what they have learned about physical and chemical changes to several scenarios.

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CHEMICAL REACTIONS (continued)

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	Storyline
In chemical reactions, the total amount of matter after the reaction is the same as the total amount of matter before the reaction.	How is mass conserved during a chemical reaction?	What happens to atoms and molecules during a chemical reaction? (Activity 4)	4, 6, 7	Atoms are reorganized and conserved in chemical reactions. Changes in the organization of particles at the atomic/molecular scale helps to explain physical and chemical changes and to distinguish one from the other.
		What happens to the mass of the reactants during a chemical reaction? (Activity 6)		The total mass of the products of a reaction equals the total mass of the reactants.
		Why is mass always conserved in chemical reactions? (Activity 7)		The conservation of atoms during reactions explains the conservation of mass.
When you mix some chemicals, they get hot or cold or give off electricity or light.	How can chemical reactions be used to provide energy?	How can we improve the design of a chemical battery? (Activity 8)	8, 9, 10, 11	Changing certain variables can affect how much energy is produced from a reaction.
		What does thermal energy have to do with chemical reactions? (Activity 9)		Chemical reactions can be used to release or absorb thermal energy.
		How do engineers design and test a prototype hand warmer? (Activity 10)		Variables can be modified as a device, such as a cold pack, is designed and refined through testing.
		How can the hand warmer design prototypes be redesigned and improved? (Activity 11)		

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CHEMICAL REACTIONS (continued)

Investigative Phenomena	Driving Questions	Guiding Questions	Activities	Storyline
Sometimes when we make a product, we get side products that we don't want— but we can do something about it.	What are the wastes from producing circuit boards, and is there anything we can do about them?	Which metal is best at reclaiming copper from the used copper chloride solution? (Activity 12)	12, 13	Several chemical reactions can be used to reclaim copper from circuit board production, and the best reaction to use can be evaluated based on several criteria.
		What is the best option for reclaiming copper metal from the used copper chloride solution? (Activity 13)		