

# FISH GET GAS, TOO

## APPLICABLE CALIFORNIA STATE STANDARDS

### Grade Seven

#### Focus on Life Science

##### Evolution

3. Biological evolution accounts for the diversity of species developed through gradual

processes over many generations. As a basis for understanding this concept:

a. *Students know* both genetic variation and environmental factors are causes of evolution and diversity of organisms.

b. *Students know* the reasoning used by Charles Darwin in reaching his conclusion

that natural selection is the mechanism of evolution.

c. *Students know* how independent lines of evidence from geology, fossils, and comparative anatomy provide the bases for the theory of evolution.

e. *Students know* that extinction of a species occurs when the environment changes

and that the adaptive characteristics of a species are insufficient for its survival.

##### Structure and Function in Living Systems

5. The anatomy and physiology of plants and animals illustrate the complementary

nature of structure and function. As a basis for understanding this concept:

b. *Students know* organ systems function because of the contributions of individual

organs, tissues, and cells. The failure of any part can affect the entire system.

### Grade Eight

#### Focus on Physical Science

2. Unbalanced forces cause changes in velocity. As a basis for understanding this concept:

b. *Students know* when an object is subject to two or more forces at once, the result is

the cumulative effect of all the forces.

c. *Students know* when the forces on an object are balanced, the motion of the object

does not change.

d. *Students know* how to identify separately the two or more forces that are acting

on a single static object, including gravity, elastic forces due to tension or compression

in matter, and friction.

e. *Students know* that when the forces on an object are unbalanced, the object will change its velocity (that is, it will speed up, slow down, or change direction).

f. *Students know* the greater the mass of an object, the more force is needed to achieve the same rate of change in motion.

### **Structure of Matter**

3. Each of the more than 100 elements of matter has distinct properties and a distinct

atomic structure. All forms of matter are composed of one or more of the elements.

As a basis for understanding this concept:

a. *Students know* the structure of the atom and know it is composed of protons, neutrons, and electrons.

b. *Students know* that compounds are formed by combining two or more different

elements and that compounds have properties that are different from their constituent elements.

d. *Students know* the states of matter (solid, liquid, gas) depend on molecular motion.

e. *Students know* that in solids the atoms are closely locked in position and can only

vibrate; in liquids the atoms and molecules are more loosely connected and can collide with and move past one another; and in gases the atoms and molecules are

free to move independently, colliding frequently.

f. *Students know* how to use the periodic table to identify elements in simple compounds.

### **Reactions**

5. Chemical reactions are processes in which atoms are rearranged into different combinations of molecules. As a basis for understanding this concept:

a. *Students know* reactant atoms and molecules interact to form products with different chemical properties.

b. *Students know* the idea of atoms explains the conservation of matter: In chemical

reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same.

c. *Students know* chemical reactions usually liberate heat or absorb heat.

### **Density and Buoyancy**

8. All objects experience a buoyant force when immersed in a fluid. As a basis for understanding this concept:

a. *Students know* density is mass per unit volume.

c. *Students know* the buoyant force on an object in a fluid is an upward force equal

to the weight of the fluid the object has displaced.

d. *Students know* how to predict whether an object will float or sink.

## **Grades Nine**

## **Through Twelve**

### **Physics**

#### **Motion and Forces**

1. Newton's laws predict the motion of most objects. As a basis for understanding this concept:

- a. *Students know* how to solve problems that involve constant speed and average speed.
- b. *Students know* that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton's first law).
- c. *Students know* how to apply the law  $F = ma$  to solve one-dimensional motion problems that involve constant forces (Newton's second law).
- d. *Students know* that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law).

### **Conservation of Energy and Momentum**

2. The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept:
- a. *Students know* how to calculate kinetic energy by using the formula  $E_k = (1/2)mv^2$ .
  - b. *Students know* how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy)  $= mgh$  ( $h$  is the change in the elevation).
  - d. *Students know* how to calculate momentum as the product  $mv$ .
  - f. *Students know* an unbalanced force on an object produces a change in its momentum.

### **Chemistry**

#### **Atomic and Molecular Structure**

1. The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure. As a basis for understanding this concept:
- d. *Students know* how to use the periodic table to determine the number of electrons available for bonding.

#### **Chemical Bonds**

2. Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules. As a basis for understanding this concept:
- a. *Students know* atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.
  - b. *Students know* chemical bonds between atoms in molecules such as  $H_2$ ,  $CH_4$ ,  $NH_3$ ,  $H_2CCH_2$ ,  $N_2$ ,  $Cl_2$ , and many large biological molecules are covalent.

#### **Conservation of Matter and Stoichiometry**

3. The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants. As a basis for understanding this concept:
- a. *Students know* how to describe chemical reactions by writing balanced equations.

### **Gases and Their Properties**

4. The kinetic molecular theory describes the motion of atoms and molecules and explains the properties of gases. As a basis for understanding this concept:

- Students know* the random motion of molecules and their collisions with a surface create the observable pressure on that surface.

### **Ecology**

6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:

- Students know* biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.

### **Investigation and Experimentation**

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:

- Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- Identify and communicate sources of unavoidable experimental error.
- Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- Formulate explanations by using logic and evidence.
- Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.
- Distinguish between hypothesis and theory as scientific terms.
- Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
- Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.
- Communicate the steps and results from an investigation in written reports