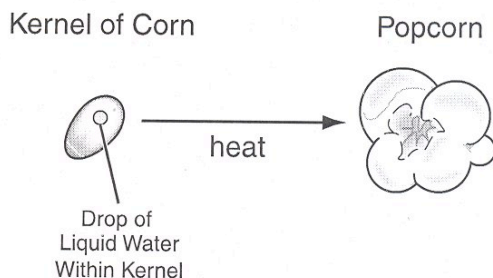


Part IV
Released Sample Items

DRAFT

9.1 – Energy cannot be created or destroyed; however, energy can be converted from one form to another.

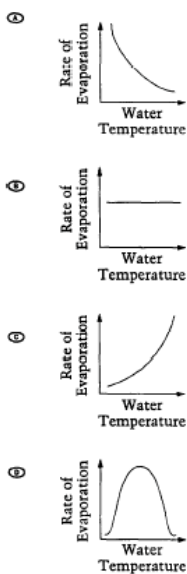
Popcorn and Cola



The drawing above shows a kernel of corn that is heated to make popcorn. Which of the following **best** explains what happens to the drop of liquid water inside the kernel of corn during this process?

- a. The liquid water is destroyed by the heat.
- b. The liquid water is converted into heat.
- c. The liquid water undergoes a physical change into steam.
- d. The liquid water undergoes a chemical change into hydrogen and oxygen.

Which of the following graphs shows how the rate of evaporation changes with changes in water temperature?



During which of the following processes is there a decrease in the heat content of the form of water indicated?

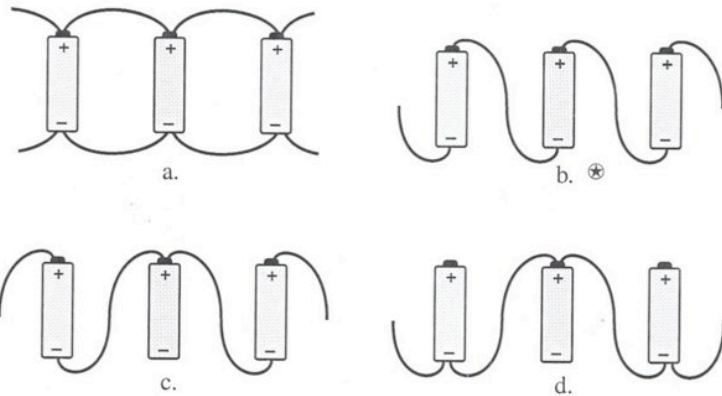
- a. Ice as it forms on a lake
- b. Water droplets as they fall to the ground
- c. Water as it evaporates from a pond
- d. Snow as it melts on a mountainside

Which of the following statements best describes the energy transformation that occurs when a log burns?

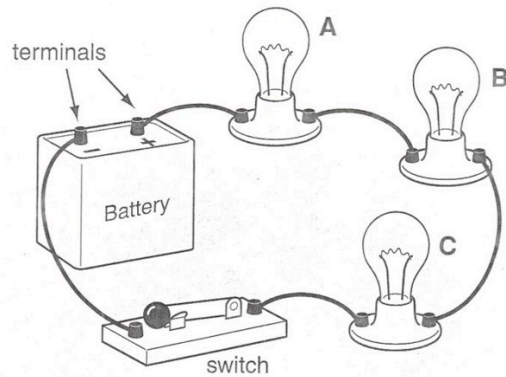
- a. Mechanical energy changes to chemical energy.
- b. Chemical energy changes to heat and light energy.
- c. Heat and light energy changes to chemical energy.
- d. Mechanical energy changes to heat and light energy.

9.2 – The electrical force is a universal force that exists between any two charged objects.

If three batteries are connected in series to the circuit, which of these shows the proper connection?



The diagram below shows a simple electrical circuit.



Which of the following would always increase the flow of current through the lights in the circuit shown above?

- a. Decreasing the battery voltage and decreasing the resistance of the lights.
- b. Increasing the battery voltage and increasing the resistance of the lights.
- c. Decreasing the battery voltage and increasing the resistance of the lights.
- d. Increasing the battery voltage and decreasing the resistance of the lights.

9.3 – Various sources of energy are used by humans and all have advantages and disadvantages.

When fossil fuels are burned to produce energy, they_____.

- a. produce air pollutants that can affect the quality of air
- b. release excess carbon dioxide that decreases the rate of photosynthesis
- c. form heavy fog from heat collecting over the oceans
- d. form radioactive particles in the atmosphere

9.4 – Atoms react with one another to form new molecules.

The Periodic Table of the Elements classifies all of the known elements into categories based on their physical and chemical properties. Repeating patterns within the table are useful in predicting how elements combine to form every kind of matter.

Partial Periodic Table

1 H 1.008	2 He 4.003																
3 Li 6.941	4 Be 9.012	13 B 10.81	14 C 12.01	15 N 14.01	16 O 16.00	17 F 19.00	18 Ne 20.18										
11 Na 22.99	12 Mg 24.31	3	4	5	6	7	8	9	10	11	12	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3

Legend:
12 ← atomic number
Mg ← chemical symbol
24.31 ← atomic weight

In order to be identified as the element carbon (C), an atom must have _____.

- f. 6 protons
- g. 6 neutrons
- h. 12 electrons
- i. 12 electrons

Group I (the alkali metals) includes lithium (Li), sodium (Na), and potassium (K). These elements have similar chemical properties because they have the same _____.

- a. numbers of protons and neutrons
- b. numbers of electrons in the outer energy level
- c. numbers of protons in the nucleus
- d. numbers of neutrons in the nucleus

Metals and nonmetals generally form ionic bonds with each other. Which of the following sets of elements will **most likely** for an ionic bond?

- f. Na, F
- g. Cl, F
- h. Na, K
- i. He, O

Which of the following is **best** classified as a compound?

- a. Helium (He), because it contains only one type of atom
- b. Oxygen (O₂), because it contains two of the same type of atoms
- c. Carbon dioxide (CO₂), because it contains two different types of atoms
- d. Manganese (Mn), because it contains a metal and a nonmetal

The chemical properties of an element are determined by its

- a. atomic mass.
- b. proton number.
- c. electron arrangement.
- d. atomic size.

The atomic number of iron is 26, and the atomic mass is 55.847. What do these numbers mean in regard to protons, electrons and neutrons?

- a. There are 26 each of protons and neutrons, and the rest of the mass is the result of electrons.
- b. There are 26 protons and 26 electrons. Some atoms of iron have 29 neutrons; the .847 shows that there is more than one isotope of iron.
- c. There are 26 protons and 29 neutrons. Each particle has an atomic mass of 1.
- d. There are 26 protons and 26 neutrons. Since neutrons have slightly more mass than protons, the mass is greater than 52.

Study the table below. Which atom has a net positive charge?

Atom	Number of Protons	Number of Neutrons	Number of Electrons
W	3	4	3
X	53	57	53
Y	55	60	54
Z	1	0	1

- a. Atom W
- b. Atom X
- c. Atom Y
- d. Atom Z

What do all of the elements listed above have in common?

- a. They are metals.
- b. They are in the same period.
- c. They have the same number of electrons.
- d. They have four electrons in their outer shells.

Refer to this portion of the periodic table to answer the question that follows.

3 Lithium Li 6.939 2,1	4 Beryllium Be 9.01218 2,2	5 Boron B 10.81 2,3	6 Carbon C 12.011 2,4	7 Nitrogen N 14.0067 2,6	8 Oxygen O 15.9994 2,6	9 Fluorine F 18.9984 2,7	10 Neon Ne 20.183 2,8
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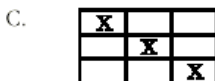
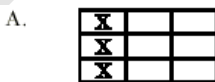
Which element in this group would be the **least likely** to react with other elements?

- a. Boron
- b. Carbon
- c. Neon
- d. Oxygen

Which of the following is the **most** important factor in determining an element's place in the periodic table?

- a. number of protons
- b. number of neutrons
- c. atomic charge
- d. atomic density

The pictures below show the position of different elements on the periodic table. Which picture has an X in the locations of the three elements that would be most similar in the way they react?



Oxygen has an atomic number of 8. Which of the following elements would you expect to be **most** similar to oxygen in terms of its chemical properties?

- a. Nitrogen (N)
- b. Fluorine (F)
- c. Sulfur (S)
- d. Chlorine (Cl)

The pH of Some Common Household Items

pH	Acid or Base Strength	Example of Substance
14	Strongly basic	Sodium hydroxide
13		
12		Ammonia
11		
10		
9		
8	Neutral	Baking soda
7		Pure water
6		Cow's milk
5		
4		Tomato juice
3		
2	Strongly acidic	Lemon juice
1		
0		Hydrochloric acid

A glass of cola was spilled on the carpet. Most colas are acidic with a pH usually between 2 and 4. Based on the pH shown above, which of the following substances could **best** be used to neutralize the spilled cola?

- a. Lemon juice
- b. Cow's milk
- c. Pure water
- d. Baking soda

9.5 – Due to its unique chemical structure, carbon forms many organic and inorganic compounds.

(No examples provided)

9.6 – Chemical technologies present both risks and benefits to the health and well-being of humans, plants and animals.

(No examples provided)

9.7 – Elements on Earth move among reservoirs in the solid earth ocean, atmosphere and organisms as part of biogeochemical cycles.

(No examples provided)

9.8 – The use of resources by human populations may affect the quality of the environment.

Insecticides and pesticides affect the environment by _____.

- f. increasing salinity of the oceans
- g. changing the landscape of an area through erosion
- h. collecting in and polluting fresh water supplies
- i. destroying fossil fuels that are important energy sources

Natasha is concerned about acid rain. A snow sample has a pH of 6.5. Natasha proposes explanations for the observed pH. Which explanation is **most** reasonable?

- a. The slightly basic pH represents clean air.
- b. The slightly acidic pH represents clean air.
- c. The acidic pH indicates that a pollution source must be upwind.
- d. The basic pH indicates that a pollution source must be upwind.

9.9 – Some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems.

Which of the following is true about recycling glass and aluminum?

- a. Energy is created in the recycling process.
- b. Recycled glass and aluminum always have different properties from the original materials.
- c. Recycling glass and aluminum reduces the amount of resources taken from the Earth.
- d. It takes more energy to recycle aluminum than to extract it from the ground.

10.1 – Fundamental life processes depend on the physical structure and the chemical activities of the cell.

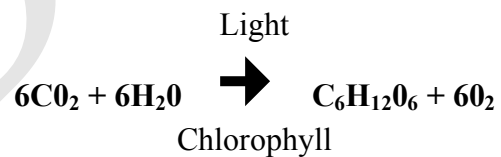
A sprig of an *Elodea* plant was placed in a test tube as shown below. The test tube was then placed in sunlight for 6 hours.



The bubbles of gas in the diagram are composed mainly of

- a. carbon monoxide
- b. carbon dioxide
- c. nitrogen
- d. oxygen

The following equation represents the process of photosynthesis in green plants.



(Carbon Dioxide + Water, in the Presence of Light and Chlorophyll → Sugar + Oxygen)

What happens to most of the light energy during photosynthesis?

- a. It is transformed into heat energy.
- b. It is transformed into chemical energy.
- c. It is changed into carbon dioxide.
- d. It is changed into oxygen.

A certain organism has many cells, each containing a nucleus. If the organism makes its own food, it would be classified as

- a. a bacterium
- b. a fungus
- c. a plant
- d. an animal

Which statement about plant and animal cells is true?

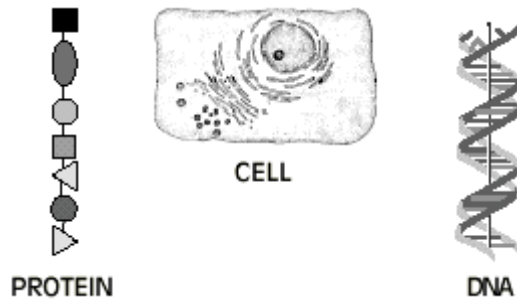
- a. Plant cells have a nucleus and a cell wall; animal cells do not have either of these structures.
- b. Plant cells have a cell wall and chloroplasts; animal cells do not have either of these structures.
- c. Plant cells have a cell wall and a cell membrane; animal cells have a cell wall but not a cell membrane.
- d. Plant cells have chloroplasts and mitochondria; animal cells have chloroplasts but do not have mitochondria.

Which statement about green plants is true?

- a. Most green plants do not need food.
- b. Most green plants take in food through their roots.
- c. Most green plants take in food through their leaves.
- d. Most green plants manufacture their own food.

In the process of photosynthesis, light energy is used to split water into hydrogen and oxygen. The hydrogen combines with carbon dioxide to ultimately produce _____.

- f. glucose
- g. nitrates
- h. chlorophyll
- j. hydrogen peroxide



What is the relationship between the three structures in the diagram above?

- a. DNA is produced by protein which is produced in the cell.
- b. Protein is composed of DNA which is produced in the cell.
- c. DNA controls the production of protein in the cell.
- d. A cell is composed only of DNA and protein.

Under what conditions will a substance be likely to enter a cell through diffusion?

- a. when the substance is a particle of food
- b. when a molecule of the substance is very large
- c. when the concentration of the substance is greater outside the cell than inside
- d. when the concentration of the substance is greater inside the cell than outside

A chromosome is best described as a

- a. gene that has more than one form.
- b. green cell found in many plants.
- c. strand of DNA containing genetic information.
- d. reproductive cell found in certain kinds of bacteria.

D INQ 9. Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

The next two questions are based on the following situation and data table.

A laboratory technician places red blood cells into three different solutions. Observations are recorded each minute for five minutes.

Solution	Time				
	1 min.	2 min.	3 min.	4 min.	5 min.
Solution 1	No change	Cells are slightly larger.	Cells are much larger.	Cells are huge.	Cells are gone.
Solution 2	No change	No change	No change	No change	No change
Solution 3	No change	Cells are slightly smaller.	Cells are much smaller.	Cells look wilted.	Nothing that looks like a cell can be found.

Which of the following best explains what is causing the red blood cells in solution 1 to change size over the five-minute period?

- a. Solvent is entering the cells faster than it is leaving the cells.
- b. Solute is entering the cells faster than it is leaving the cells.
- c. The cells are making new protein.
- d. The cell's membranes are dissolving.

The laboratory technician concludes that red blood cells cannot function in any fluid except serum. Which of the following best characterizes this conclusion?

- a. It is accurate on the basis of the information given.
- b. It is accurate because the cells changed in all the solutions but one.
- c. It is inaccurate because the cells were outside the body.
- d. It cannot be substantiated with the data provided.

10.2 – Microorganisms have an essential role in life processes and cycles of Earth.

The patient needed a vaccination. Vaccinations prevent disease by _____.

- a. preventing viral DNA from entering the body
- b. destroying toxins produced by bacteria
- c. stimulating the production of antibodies
- d. increasing red blood cell production

10.3 – Similarities in the chemical and structural properties of DNA in all living organisms allow the transfer of genes from one organism to another.

(No examples provided)

10.4 – In sexually reproducing organism, each offspring contain a mix of characteristics inherited from both parents.

In fruit flies, gray body color (G) is dominant over black body color (g). What kind of offspring would you expect from parents who are both heterozygous for body color (Gg x Gg)?

	G	g
G		
g		

- a. 0% gray, 100% black
- b. 25% gray, 75% black
- c. 75% gray, 25% black
- d. 100% gray, 0% black

Which statement about DNA is correct?

- a. A child's DNA will be unrelated to the mother's or father's DNA.
- b. A child's DNA will show similarities to both the mother's and father's DNA.
- c. A female child's DNA will exactly match the mother's DNA.
- d. A male child's DNA will exactly match the father's DNA.

If an intestinal cell in a butterfly contains 24 chromosomes, a butterfly egg cell would contain

- a. 3 chromosomes.
- b. 6 chromosomes.
- c. 12 chromosomes.
- d. 24 chromosomes.

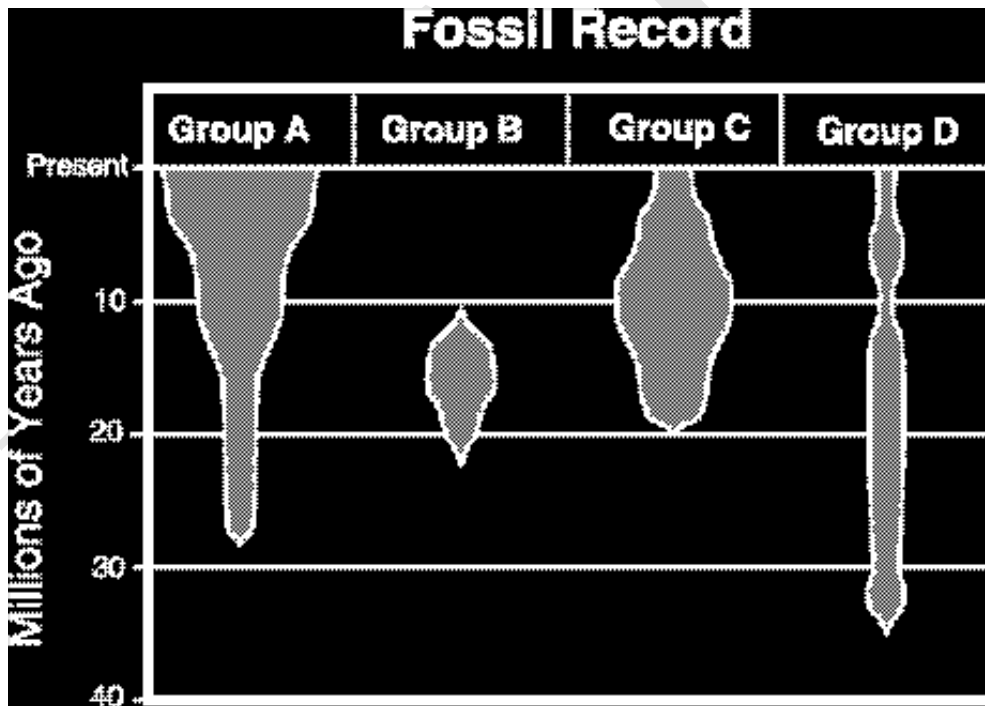
Body cells of fruit flies contain only 8 chromosomes, compared to human cells that contain 46. Scientists used studies of fruit flies to discover how egg and sperm cells (gametes) are formed. What did they observe?

- Body cells of the offspring flies had 16 chromosomes.
- Sperm cells from the male had 8 chromosomes.
- Egg cells from the female had 4 chromosomes.
- Body cells of the offspring flies had 4 chromosomes.

10.5 – Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.

D INQ 9. Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

In a section of the Grand Canyon, scientists have found the fossil remains of several different groups of organisms. The diagram below represents the number and age of the fossils the scientists found. The width of each shaded area in the diagram below indicates the relative number of fossils found.



Which of the following statements is supported by the fossil record?

- Group C is now extinct.
- Group D has been in existence the longest.
- Group A is the most recent organism to come into existence.
- Group B was the most numerous organism 10 million years ago.

Which of the following is usually **most** helpful in determining the age of these fossils?

- a. the size of the fossils
- b. the color of the fossils
- c. the amount of surface area of the rock layer in which the fossils are found
- d. the depth of the rock layer in which the fossils are found

The scientists hypothesize that the four groups of fossilized organisms originated from a common ancestor. Which of the following would provide the **best** evidence that their hypothesis is correct?

- a. the number of fossils found in each group is similar.
- b. present-day members of the groups live in the same environment.
- c. fossils from each group were found in the same rock layer.
- d. members of the groups have similar physical structures.

Water is necessary for life. During Connecticut winters, the ground freezes, making it difficult for trees to absorb water. How are Connecticut trees adapted to survive cold winters?

- a. They use sap as a water source.
- b. They reverse the photosynthetic process.
- c. They drop their leaves and become dormant
- d. They use the water produced during cellular respiration.

10.6 – Living organisms have the capability of producing populations of unlimited size, but the environment can support only a limited number of individuals from each species.

(No examples provided)

Additional Assessment Information

Several Connecticut State Department of Education (CSDE) publications and resources are available through the CSDE website: www.state.ct.us/sde. Documents are regularly updated.

Curriculum Frameworks

<http://www.state.ct.us/sde/dtl/curriculum/index.htm>

- All Disciplines (Grades PK-12)

State Testing

<http://www.csde.state.ct.us/public/cedar/assessment/index.htm>

- Connecticut Mastery Test (Grades 3-8)
<http://www.csde.state.ct.us/public/cedar/assessment/cmt/index.htm>
- Connecticut Academic Performance Test (Grade 10)
<http://www.csde.state.ct.us/public/cedar/assessment/capt/index.htm>

National Testing

<http://www.csde.state.ct.us/public/cedar/assessment/national/index.htm>

- Advanced Placement (AP)
<http://www.csde.state.ct.us/public/cedar/assessment/national/ap.htm>
- National Assessment of Educational Progress (NAEP)
<http://www.csde.state.ct.us/public/cedar/assessment/national/naep.htm>
- Preliminary Scholastic Aptitude Test (PSAT)
<http://www.csde.state.ct.us/public/cedar/assessment/national/psat.htm>
- Scholastic Aptitude Test (SAT)
<http://www.csde.state.ct.us/public/cedar/assessment/national/sat.htm>
- Third International Math and Science Study (TIMMS)
<http://www.csde.state.ct.us/public/cedar/assessment/national/timms.htm>

No Child Left Behind

<http://www.csde.state.ct.us/public/cedar/nclb/index.htm>