



SCIENCE Middle SCHOOL CIA

Dec 18, 2006

0-3 min-Start: Announcements:  
Attendance/ Sign In

Science Fair Questions

Explanation of Curriculum Process

3-6 min -Quarterly Assessments Discussion:  
Given out at Oct CIA...  
Rubrics discussed, opportunities for feedback.  
Jan Midterms: 10-15 questions for central office scoring/feedback.  
"Common" Midterms among courses in dept.

6-28 min Professional Topic of the Day:  
Assessment: Constructed Response: [Discussion/Notes](#)

28- 75 min Break Out Tables: By Group/Grade.

Task:

Using the state standards/performances for your grade level:

As a group, last time you identified some key misconceptions that students would have about these topics.

This time, use your exam questions, and examples to formulate some GOOD multiple choice questions.

Leave notes for supervisor to assimilate and review.

**Richard Therrien**

*K-12 Science Supervisor*

New Haven Schools

54 Meadow Street, 3<sup>rd</sup> Floor

New Haven, CT 06519

**Phone:** 203-946-7933

**Fax:** 203-946-8664

[Richard.therrien@new-](mailto:Richard.therrien@new-)

[haven.k12.ct.us](mailto:Richard.therrien@new-haven.k12.ct.us)

<http://www.newhavenscience.org>

I) **What** are we testing??

Level of Bloom's: Recall, Comprehension, Analysis, Evaluation?

- a) What is the correct word for this definition?
- b) What is the correct explanation for this process?
- c) What is the correct prediction for this event?
- d) What is the best explanation?
- e) What is the score you might give this group?

II) Does the question test what we want? Does it fit the objectives? Does it match the performance standards?

III) Can the question sort through and find out student's misconceptions?

(What is the best explanation for the seasons?)

IV) Is the question a true assessment of science, or of test-taking or guessing strategies?

What do we want to test? (Find the objective)

Frame the question... focus only on the concept we want to test.

Write ALL possible correct answers, pick the obvious one.

Create distractors... focus on misconceptions, use for formative feedback.

### ***Reducing cognitive load (Focusing the thinking on the science in the question)***

- Keep the stem simple, only including relevant information. Avoid lifting phrases directly from text or lecture. This becomes a simple recall activity for the student. Use new language as frequently as possible.
- Keep the alternatives simple by adding any common words to the stem rather than including them in each alternative.
- Put alternatives in a logical order.
- Limit the use of negatives (e.g., NOT, EXCEPT).
- Include the same number of alternatives for each item.

### ***Reducing the chance of "guessing" correctly***

- Keep the grammar consistent between stem and alternatives. Answer options should be about the same length and parallel in grammatical structure. Too much detail or different grammatical structure can give the answer away. Avoid including an alternative that is significantly longer than the rest.
- Make all distractors plausible. Distractors must be incorrect, but plausible. If possible, include among the distractors options that contain common errors. Students will then be motivated to listen to explanations of why those options are incorrect.

To make distractors more plausible, use words that should be familiar to students.

If a recognizable key word appears in the correct answer, it should appear in some or all of the distractors as well. Don't let a verbal clue decrease the accuracy of exam.

*For example*, someone with no biology background would not have to think very hard to make a correct guess on this question:

*Every organism is made of cells and every cell comes from another cell. This is the:*

*a) Relativity Theory b) Evolution Theory c) Heat Theory d) Cell Theory*

- Avoid giving too many clues in your alternatives.
- Do not test students on material that is already well-learned prior to your instruction.
- Limit the use of "all of the above" or "none of the above."
- Limit the use of always, never or similar terms.

If item alternatives include multiple terms or series of concepts, avoid over-representing or under-representing certain terms or concepts. Most literature recommends writing the correct answer before writing the distractors. This makes sure you pay enough attention to formulating the one clearly correct answer.

- Avoid direct quotations from a text in an item.
- Avoid alternatives that are opposites if one of the two must be true.
- Distribute correct answers fairly evenly among the "letters."
- Avoid "giveaway" items.
- Avoid providing clues for one item in the wording of another item on the test.

**WORTH REPEATING: Make sure items actually measure what they are intended to measure.**

## ***Techniques for Writing Multiple-Choice Items that Demand Critical Thinking***

### **Premise - Consequence**

Students must identify the correct outcome of a given circumstance.

**Example:** If nominal gross national product (GNP) increases at a rate of 10% per year and the GNP deflator increases at 8% per year, then real GNP:

Remains constant. b) Rises by 10%. c) Falls by 8%. d) Rises by 2%.

**Note:** To increase the difficulty, provide more than one premise.

### **Analogy**

Students must map the relationship between two items into a different context:

**Example:** E-mail is to an unmoderated listserv as office hours are to:

Class lecture. b) Class discussion. c) Review sessions. d) Tutorials.

### **Case Study**

A single, well-written paragraph can provide material for several follow-up questions.

**Example:**

Alice, Barbara, and Charles own a small business: the Chock-Full-o-Goodness Cookie Company. Because Charles has many outside commitments and Barbara has a few, Alice tends to be most in touch with the daily operations of Chock-Full-o-Goodness. As a result, when financial decisions come down to a vote at their monthly meeting, they have decided that Alice gets 8 votes, Barbara gets 7, and Charles gets 2—with 9 being required to make the decision. According to *minimum-resource* coalition theory, who is most likely to be courted for their vote?

a) Alice b) Barbara c) Charles d) No trend toward any specific person.

In the scenario in question 1, according to *minimum-power* coalition theory, who is most likely to be courted for their vote?

a) Alice b) Barbara c) Charles d) No trend toward any specific person.

### **Incomplete Scenario**

Students must respond to what is missing or needs to be changed within a provided scenario. Note: when using a graph or image, try to lay it out differently than how the students have seen it. This is equivalent to using new language to present a familiar concept and prevents students from using rote memorization to answer the question. For example, the diagram below may originally have been split left to right instead of top to bottom, and this diagram may not be as detailed as the diagram they saw in the book.)

**Example:** Use the diagram below to answer the following questions.

What belongs in the empty box in the upper right corner of the diagram?

### **Problem/Solution Evaluation**

Students are presented a problem and a proposed solution. They must then evaluate the proposed solution based upon criteria provided.

**Example:** A student was asked the following question: "Briefly list and explain the various stages of the scientific process."

*As an answer, this student wrote the following:*

"The scientific process is believed to take place in five stages, in the following order: problem, when the problem must be identified and defined, design, , experimentation, analysis, , and finally conclusion."

*How would you judge this student's answer?*

EXCELLENT (all stages correct in the right order with clear and correct explanations)

b) GOOD (all stages correct in the right order, but the explanations are not as clear as they should be) c)

MEDIOCRE (one or two stages are missing OR the stages are in the wrong order, OR the explanations are not clear OR the explanations are irrelevant) d) UNACCEPTABLE (more than two stages are missing AND

the order is incorrect AND the explanations are not clear AND/OR they are irrelevant)

EXAMPLES OF “GOOD” MULTIPLE CHOICE SCIENCE QUESTIONS....

Which is an example of water condensing?

- A) A puddle disappearing on a hot summer afternoon
- B) Sweat forming on your forehead after you do a lot of exercise
- C) Ice cubes melting when you put them out in the sun
- D) Dew forming on plants during a cold night

How do most fish get the oxygen they need to survive?

- A) They take in water and break it down into hydrogen and oxygen
- B) Using their gills, they take in oxygen that is dissolved in water.
- C) They get their oxygen from the food they eat.
- D) They come to the surface every few minutes to breathe air into their lungs.

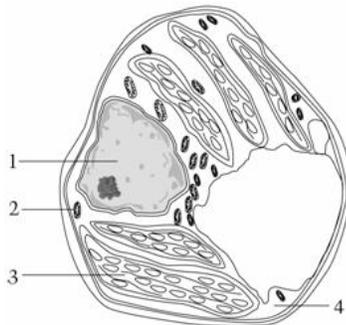
An unusual type of fossil clam is found in rock layers high in the Swiss Alps. The same type of fossil clam is also found in the Rocky Mountains of North America. From this, scientists conclude that

- A) glaciers carried the fossils up the mountains
- B) the Rocky Mountains and the Swiss Alps are both volcanic in origin
- C) clams once lived in mountains, but have since evolved into sea-dwelling creatures
- D) the layers of rocks in which the fossils were found are from the same geologic age

Which of the following is an example of genetic engineering?

- A) Growing a whole plant from a single cell.
- B) Finding the sequences of bases in plant DNA.
- C) Inserting a gene into plants that makes them resistant to insects.
- D) Attaching the root of one type of plant to the stem of another type of plant.

In the picture of a cell below, which label indicates the part of the cell that contains most of the cell's genetic material?



	Charcoal	Carbon Dioxide
Formula	C	CO <sub>2</sub>
State at Room Temperature	Solid	Gas
Soluble in Water	No	Yes
Combustible in Air	Yes	No

Based on the information in the table above, which is a reasonable hypothesis regarding elements and their compounds?

- A) An element retains its physical and chemical properties when it is combined into a compound.
- B) When an element reacts to form a compound, its chemical properties are changed but its physical properties are not.
- C) When an element reacts to form a compound, its physical properties are changed but its chemical properties are not.
- D) Both the chemical and physical properties of a compound are different from the properties of the elements of which it is composed.

Which is a function of a neuron?

- A) It carries oxygen to other cells.
- B) It secretes digestive enzymes.
- C) It removes foreign particles from the bloodstream.
- D) It receives signals from the internal and external environments.

When sulfuric acid,  $\text{H}_2\text{SO}_4$ , is broken down into separate elements, how many different elements result?

- A) Two
- B) Three
- C) Six
- D) Seven

Which of the following observations about a certain pure solid would indicate most strongly that the solid is ionic?

- A) Its water solution is a good conductor of electricity.
- B) It is composed of small white crystals.
- C) It has a density greater than  $1.0 \text{ gram/cm}^3$ .
- D) It has a high melting point. Beans and coal both have stored energy.

Where did the energy come from that is stored in beans and coal?

- A) From the Earth's gravity
- B) From the Sun's light
- C) From the heat in the Earth's core
- D) From the air's carbon dioxide

Which of the following is most consistent with the modern theory of evolution?

- A) Parents pass their physical traits to their offspring; those offspring with traits that help them survive in the environment are able to reproduce.
- B) Parents change their physical traits in order to survive in the environment, then those parental traits are passed to their offspring.
- C) Life on this planet came from another planet far out in space.
- D) Living organisms have not changed for hundreds of millions of years.

Air in the atmosphere continuously moves by convection. At the equator, air rises; at the poles, it sinks. This occurs because

- A) the Earth's ozone layer is thinner at the equator than at the poles
- B) the Earth's magnetic field is stronger at the poles than at the equator
- C) warm air can hold less water vapor than can cold air
- D) warm air is less dense than cold air

Is there gravity in space? Which of the following gives the best response to this question?

- A. No. You can see that astronauts float around weightless in their cabin.
- B. No. There is no air in space, so gravity cannot exist there.
- C. Yes. There must be gravity since planets keep circling the sun.
- D. Some. The moon has one-sixth as much gravity as Earth, so we know there is some gravity in space.

Some Web Resources:

-<http://tep.uoregon.edu/resources/assessment/multiplechoicequestions/mc4critthink.html>

***Writing Multiple-Choice Questions that Demand Critical Thinking from the Teacher Effectiveness Project***

How to write a good multiple choice question, tutorial

<http://hotpot.uvic.ca/howto/mcquestion.htm>

Authentic Assess Toolbox

<http://jonathan.mueller.faculty.noctrl.edu/toolbox/tests/gooditems.htm>

BOOKS:

AMSCO:

Achieving Competency In Science

Science Proficiency Review

Reviewing Chemistry

Reviewing Biology

Reviewing Earth Science

Reviewing Physical Science

Globe Fearon: National Science Review Book

NSTA: Science Educator's Guide To Assessment

NAEP Test BanK

<http://nces.ed.gov/nationsreportcard/itmrls/startsearch.asp>

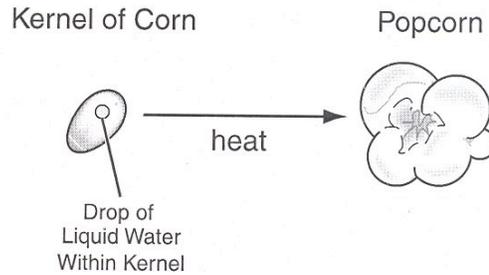
[CAPT released items](#)

[Sample CAPT 9th Grade Test](#)

CAPT SAMPLE RELEASED ITEMS

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

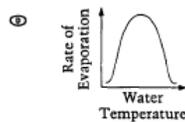
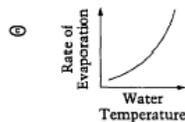
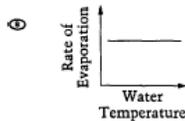
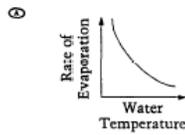
## Popcorn and Cola



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

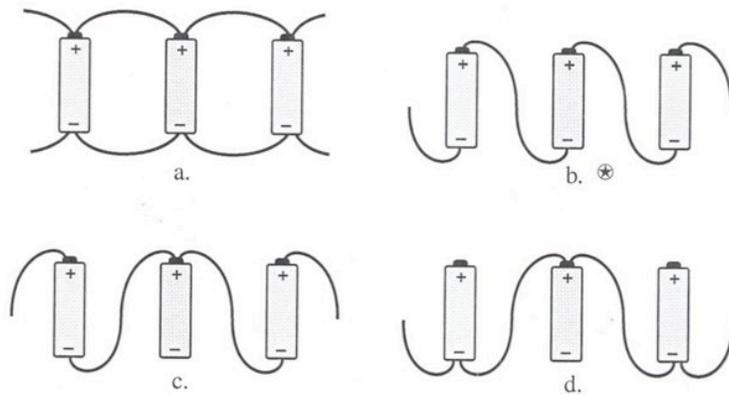
- c. Water as it evaporates from a pond
- d. Snow as it melts on a mountainside

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

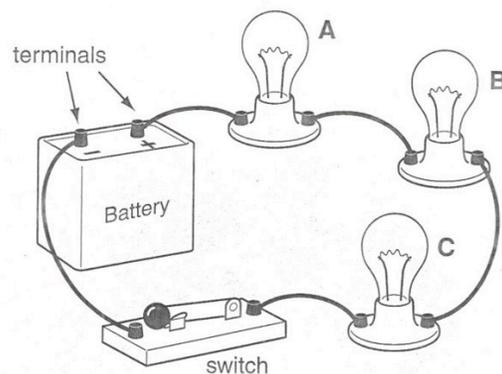
- a. Mechanical energy changes to chemical energy.
- b. Chemical energy changes to heat and light energy.
- c. Heat and light energy changes to chemical energy.
- d. Mechanical energy changes to heat and light energy.

**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?

- Decreasing the battery voltage and decreasing the resistance of the lights.
- Increasing the battery voltage and increasing the resistance of the lights.
- Decreasing the battery voltage and increasing the resistance of the lights.
- 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 \_\_\_\_\_.

- produce air pollutants that can affect the quality of air
- release excess carbon dioxide that decreases the rate of photosynthesis
- form heavy fog from heat collecting over the oceans
- 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												12						18	
1 H 1.008	2												13	14	15	16	17	18 He 4.003	
3 Li 6.941	4 Be 9.012												5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 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		

← atomic number  
← chemical symbol  
← atomic weight

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

- 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** form 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 (O<sub>2</sub>), because it contains two of the same type of atoms
- c. Carbon dioxide (CO<sub>2</sub>), 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 <b>Li</b> 6.939 2,1	4 Beryllium <b>Be</b> 9.01218 2,2	5 Boron <b>B</b> 10.81 2,3	6 Carbon <b>C</b> 12.011 2,4	7 Nitrogen <b>N</b> 14.0067 2,6	8 Oxygen <b>O</b> 15.9994 2,6	9 Fluorine <b>F</b> 18.9984 2,7	10 Neon <b>Ne</b> 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?

A.

X		
X		
X		

B.

X	X	X

C.

X		
	X	
		X

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		Lemon juice
1		
0	Strongly acidic	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.**

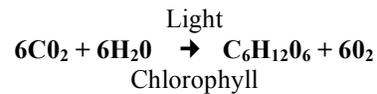
A sprig of an *Elodea* plant was placed in a test tube as shown below. The test tube was then placed in sunlight for 6 hours.



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?

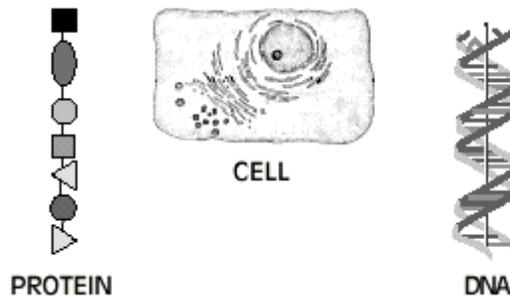
- a. Plant cells have a nucleus and a cell wall; animal cells do not have either of these structures.
- b. Plant cells have a cell wall and chloroplasts; animal cells do not have either of these structures.
- c. Plant cells have a cell wall and a cell membrane; animal cells have a cell wall but not a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

relationship between the three

- 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?

- Solvent is entering the cells faster than it is leaving the cells.
- Solute is entering the cells faster than it is leaving the cells.
- The cells are making new protein.
- 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?

- It is accurate on the basis of the information given.
- It is accurate because the cells changed in all the solutions but one.
- It is inaccurate because the cells were outside the body.
- 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)?

	<b>G</b>	<b>g</b>
<b>G</b>		
<b>g</b>		

- 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?

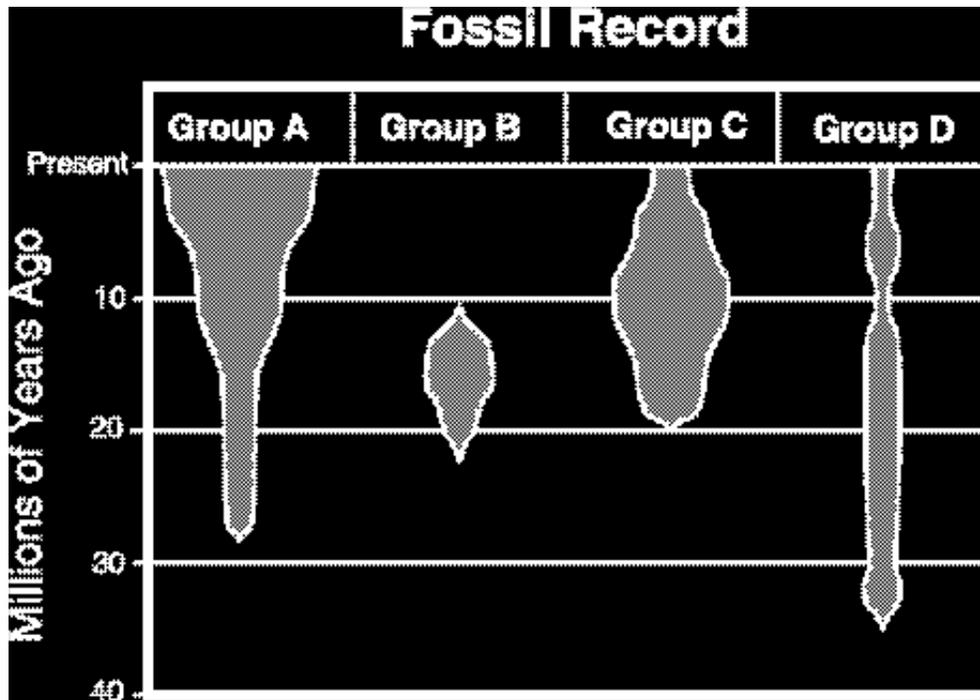
- a. Body cells of the offspring flies had 16 chromosomes.
- b. Sperm cells from the male had 8 chromosomes.
- c. Egg cells from the female had 4 chromosomes.

d. 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?

- a. Group C is now extinct.
- b. Group D has been in existence the longest.
- c. Group A is the most recent organism to come into existence.
- d. 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)***