

O.G.T. SCIENCE TEST: QUICK STUDY GUIDE

Chemistry

Matter

Two main families of matter: MIXTURES and SUBSTANCES

MIXTURES can be separated by physical means

HOMOGENEOUS- all parts are equal and look the same (Kool-Aid)

HETEROGENEOUS- parts are in different proportions and can be easily identified (chocolate chip ice cream)

SUBSTANCES cannot be separated by physical means

ELEMENTS- subs that are made of one kind of matter

COMPOUNDS- 2 or more elements bonded together

States of matter

Solid-molecules vibrate but have a fixed position (definite volume and shape)

Liquid -molecules can flow easily past one another (def. volume; take shape of container)

Gas - molecules move freely (no def. shape or volume)

Plasma- extremely high energy state of matter (no def shape or volume)

Phase changes

S→L= melting

L→G = evaporation

L→S= freezing

G→L= condensation

S→G= sublimation

G→S = deposition

Molecules speed up as they go from a solid to a liquid to a gas; they slow down if they move from a gas to a liquid to a solid

Atomic Structure

Protons- positive particles in the nucleus

Neutrons- neutral particles in the nucleus

Electrons- negative particles in energy levels

Nucleus- center of atom; contains the atoms mass

Valence electrons- electrons on last energy level of any atom (Magic number is 8)

Energy levels- fixed paths or orbits surrounding nucleus where electrons are found

Periodic Table Basics

Atomic number= number of protons of an element (whole number)

Atomic mass= protons + neutrons (average mass of isotopes; the one with the decimal)

Atomic symbol= used to represent an element

Atomic name= name given to element

Isotope= same element with different number of neutrons

Periodic Table Trends

Group/Family- Vertical columns on the periodic table

Periods- horizontal rows on the PT

Group number (except for transition metals) represent numbers of valence electrons for a certain family

Oxidation number- number of gained or lost valence electrons for each family

Positive #- metals; they give away

Ve's to be chemically stable

Negative #- nonmetals; they

receive Ve's to be chemically stable

Noble gases- chemically stable- have all 8 valence e's except He (happy with its 2!)

Notable Periodic Families

Group 1- Alkali Metals

Group 2- Alkaline Earth Metals

Groups 3-10ish - Transition metals

Group 7- Halogens

Group 8- Noble Gases

Bonding

Ionic bonding- transferring of valence electrons from a metal to a non metal (i.e. Na to Cl); oxidation number assigned as Ve's are lost or gained

Covalent bonding- complete sharing of valence electrons between two non metals (i.e. S and O); no oxidation numbers assigned

Signs of Chem Reaction

Bubbles (gas formation)

Light/heat

Change in color

Change in odor

Formation of a solid

Physical vs. Chemical Properties/Changes

Physical- reversible; does not change identity or make up of matter (reversible)

Chemical- creates a new substance; starting materials are completely different from ending materials (not reversible)

Law of Conservation of Energy/Mass- Energy or mass cannot be created or destroyed it simply changes forms

Mass of reactants= mass of products (sub energy for mass)

Acids/Bases

Acids- low pH; sour taste
pH range 6.9-0

Bases- high pH; bitter taste
pH range 7.1-14

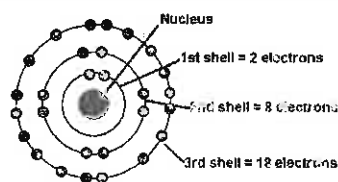
pH scale 0-14; 7 is neutral
water is neutral

DENSITY

density = mass/volume

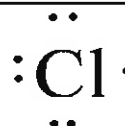
Substances that are MORE dense SINK.

Substances that are LESS dense RISE.



Bohr Model

Lewis Dot Diagram
Valence electron config.



O.G.T. SCIENCE TEST: QUICK STUDY GUIDE

Physics

Forces and Motion (Newton's Laws)

Force = An action exerted on a body in order to change that body's state of rest or motion.

Examples of Force: Push, Pull, Gravity, friction.

Motion = An objects change in position relative to a reference point.

Speed = An objects distance divided by the time it takes to move that distance. Speed can be measured as an average speed or an instantaneous speed.

Velocity = speed with direction.

Acceleration = The change in an objects speed over time.

Newton's 1st Law: an object in motion stays in motion and an object at rest stays at rest unless acted on by an outside force. Also referred to as **Inertia**.

Newton's 2nd Law: $F = ma$ (Force = mass X acceleration)

Newton's 3rd Law: for every action force there is an equal and opposite reaction force.

Net Force = The sum of all forces acting on an object. If the net force is zero then forces are balanced.

Friction = A force that opposes motion between two surfaces that are in contact. Friction will slow an object down. Types of friction are static, sliding, rolling, and air resistance.

Gravity: Under ideal conditions, objects fall to the ground at the same rate; it does not matter if one is heavier than the other. The constant for the acceleration of gravity is 9.8m/s/s.

Waves

Wave = A disturbance that carries energy through matter or space.

Mechanical wave = A wave that requires a medium through which to travel. (ex. air or water or glass)

Medium = A physical environment in which phenomena occur.

Electromagnetic wave = A wave that consists of oscillating (alternating back and forth) electric and magnetic fields.

Transverse wave = A wave in which particles in the medium move perpendicular to the motion of the wave.

Ex. Waves on the ocean.

Longitudinal wave = A wave in which particles of the medium vibrate parallel to the motion of the wave. Ex. the compression and expansion on an accordion.

Parts of a wave

Crest – The highest point of a wave

Trough – The lowest point of a wave

Wavelength – The distance from any point on a wave to an identical point on the next wave.

Amplitude – The distance that particles vibrate from the resting point.

ENERGY

Energy = The capacity to do work.

Work = The force placed on an object to move it a distance or ($f \times d$). It is expressed in the unit joules.

Power = The amount of time it takes to do work or (w/t). It is expressed in watts.

potential energy – an object's stored energy. It is an energy of position. The higher an object the more potential energy it would have. The formula for calculating potential energy is $PE = mgh$ (mass X gravitational constant X height)

kinetic energy – an object's energy while in motion (*the faster it moves, the more kinetic energy it has*). The formula for calculating kinetic energy is

$KE = \frac{1}{2} mv^2$ (one half the mass X velocity squared)

Forms of potential and kinetic energy – mechanical, chemical, heat (thermal), light (radiant), electrical, sound, nuclear.

The **law of conservation of energy** states that energy cannot be created or destroyed but just changes from one form to another.

Nuclear energy is produced through the **fission** (splitting) of atoms or the **fusion** (combining) of atoms. The sun produces energy by fusing hydrogen into helium.

Radioactive Decay = The disintegration of an unstable atomic nucleus.

Half Life = The time required for half of a sample of radioactive substance to break down by radioactive decay. Example if Carbon's half life is 5730 years and I have a 100 g sample then there would be 50 g left after 5730yr.

Wave Interactions – Sound – Light

Reflection – The bouncing back of a ray of light, sound, or heat when it hits a surface it cannot go through.

Refraction – The bending of a wave as it passes between two substances in which the speed differs.

Diffraction – A change in the direction of a wave when hits an obstacle, edge, or opening.

Interference – The combination of two or more waves that results in a single wave.

Constructive interference – two waves produce a single wave that is equal to the sum of the two waves.

Destructive interference – two waves produce a single wave that is equal to the difference between the two original waves.

Resonance – occurs when two objects vibrate at the same frequency. It is used to amplify the sound of instruments.

SONAR – SOund Navigation And Ranging . It uses acoustic signals and echoes to determine the location of objects.

Electromagnetic spectrum – Consists of waves at all possible frequencies. Radio wave, microwaves, infrared waves, visible light waves, ultraviolet waves, xrays, and gamma rays.

RADAR – RAdio Detection And Ranging. Uses reflected radio waves to determine both the velocity and location of objects.

O.G.T. SCIENCE TEST: QUICK STUDY GUIDE

PLATE TECTONICS

The Earth's outer layer is broken up into 7 **lithospheric plates**. This is sometimes referred to as the **CRUST**.

The plates move due to **convection currents (circular motion of heat rising)** inside the **ASTHENOSPHERE** or **MANTLE**.

When the plates move, many things can happen including **volcano eruptions, earthquakes, mountain building, seafloor spreading, etc.**

TRANSFORM FAULT BOUNDARIES

When two plates **move horizontally** past one another, which occasionally get caught together. They then break free in a violent separation causing **Earthquakes** to occur.

Fault – a break in a body of rock

Focus – The point below ground where the earthquake originates

Epicenter – The point on the surface above the focus

Richter Scale – measurement scale for strength of earthquake

CONVERGENT BOUNDARIES

When two tectonic plates **move towards each other**, resulting in a collision

Outcome of Continental-Continental: **folding, mountain building**

Outcome of Continental-Oceanic: **subduction zone** formed (ocean dives beneath continental due to greater density) where **volcanoes** form

Outcome of Oceanic-Oceanic: **Islands** may form in shape of Arc

DIVERGENT BOUNDARIES

When two plates **move away from each other**.

Outcome: **Underwater volcanoes** form in gaps formed from plates moving apart, also form **Mid-Ocean Ridges**.

Oceanic crust is pushed away from MOR and gets **older, colder and more dense** the further away it gets

MISCELLANEOUS PLATE TECTONICS

Evidence for Plate Tectonics: **Fossils** on different continents are the same, **sedimentary layers** are same on different continents, and continents fit together like **puzzle pieces**.

Magnetic Banding in rocks align with North Pole, so they vary every few hundred thousand years.

LAYERS OF THE EARTH

Crust – outermost layer, made of solid rock. 3-5 miles thick

Mantle – Denser than crust, 80% of earth's total volume, made of molten rock that flows, in between the crust and core

Outer Core – Made of liquid iron and nickel due to high temperature and pressure

Inner Core - made solid iron and nickel due to extreme pressure which does not allow the heat to keep it as a liquid

OTHER TERMS FROM EARTH SCIENCE

Primary Waves (P-Waves) – the first waves to reach recording stations during earthquakes, they are longitudinal

Secondary Waves (S-Waves) – the second waves to reach recording stations during earthquakes, they are transverse

Seismograph – instrument used to record earthquake waves, and used to determine the focus of a quake (need 3 stations to find the exact focus of an earthquake)

Igneous Rock – molten rock that has cooled on earth's surface

Metamorphic Rock – rock whose texture and mineral content has changed inside of the earth due to heat and pressure

Sedimentary Rock – rock that forms from compressed or cemented layers of sediment on earth's surface.

Older Sedimentary Rock is buried lower in the ground,

OTHER TERMS CONTINUED

Weathering – Breaking rock into smaller pieces but it does not alter the chemical composition of the rock

Physical Weathering – physically breaking rock due to abrasion, frost wedging, or other pressure applied to the rock

Chemical Weathering – causes rock to weaken, decompose, or dissolve and it can affect the chemical composition of rock

Erosion – the removal or transportation of weathered and nonweathered materials by gravity, running water, wind, waves, ice and underground water

Deposition – process in which sediment moves by erosion, is dropped and comes to rest

Hot Spot – a hole in the crust that comes up from the mantle resulting in island chains as the plate moves over the plume

LAST MINUTE NOTES:

O.G.T. SCIENCE TEST: *QUICK STUDY GUIDE*

Words to know

Fusion- a nuclear reaction that combines the nuclei of two smaller elements into one larger one

Gravity- the attractive force between matter

Supernova- large explosion that results in the death of very massive stars

Wavelengths- the distance between two crests or two troughs on a wave

Satellites – any celestial body that revolves around something that isn't the sun (i.e. the Moon)

Black hole- object with so much mass and gravitational force that nothing, not even light can escape its pull

Stars

-Very massive balls of gas

-Give off heat, light and other radiation through **fusion**

-Most stars fuse two hydrogen atoms into one helium atom

-Only stars that are more massive than our sun (10x more massive) have enough pressure generated by **gravity** to make heavier elements (lithium through iron)

-Only through a **supernova** of a very massive star (100x more massive than our sun) can generate enough energy to create elements heavier than iron (cobalt through uranium)

-A star's temperature is related to its color

red---orange---yellow---white---blue
coolest hottest

Solar system

-**gravity** defines the motion of things in the solar system

-The Sun is the most massive object in the Solar System, all planets, asteroids and comets revolve around it

-Smaller **satellites** revolve around planets and other bodies

Big Bang

-The big bang theory explains how the **Universe** was created

-States that the Universe started as a very, very small dot, out of which all matter and energy that exists exploded

-over time that matter became organized into atoms, stars and galaxies

Evidence of Big Bang Theory

1. Light from galaxies is being **Red Shifted** → this means that galaxies are moving away from each other and the space between them is getting larger → this means the universe must be expanding

2. **Cosmic Background Radiation** is thermal radiation that fills the universe without an apparent source → it is left over energy from the explosion that created the universe

Doppler Effect

-**Wavelengths** of sound, light, or other radiation change if the object that is giving the waves off is moving

Blue shift- wavelengths are getting shorter because the object is moving closer to the observer

Red shift- wavelengths are getting longer because the object is moving further from the observer

LAST MINUTE NOTES:

SCIENCE O.G.T. TERMS

Acid	A substance that dissolves in water with the formation of hydrogen ions and reacts with a base to form a salt and water. It neutralizes alkalis, dissolves some metals, and turns litmus red; typically, a corrosive and sour-tasting liquid.
Adaptation	Adjustment to environmental conditions, modification of an organism or its parts that makes it more fit for existence under the conditions of its environment.
Atom	The smallest particle of an element that can exist either alone or in combination.
Base	A substance that dissolves in water with the formation of hydroxyl ions and reacts with an acid to form a salt and water; turns litmus paper blue.
Biome	Major ecological community (tropical rain forest, grassland or desert).
Compound	A substance formed from two or more elements chemically united in fixed proportions.
Dependent variable	A variable whose values are determined by one or more (independent) variables.
Element	Any of more than 100 fundamental substances that consist of atoms of only one kind and that singly or in combination constitute all matter.
Energy	The capacity for doing work, can be in various forms such as nuclear, sound, thermal and light.
Heredity	The sum of the qualities and potentialities genetically derived from one's ancestors; the relation between successive generations, by which characteristics persist.
Homeostasis	A state of equilibrium between different but interrelated functions or elements, as in an organism or group.
Isotope	Any of two or more species of atoms of a chemical element with the same atomic number and nearly identical chemical behavior, but with differing atomic mass or mass number and different physical properties.
Kinetic energy	Energy associated with motion.
Mass	The property of a body that is a measure of its inertia and that is commonly taken as a measure of the amount of material it contains causing it to have weight in a gravitational field.



Matter	Material substance that occupies space, has mass and is composed of atoms consisting of protons, neutrons and electrons that constitutes the observable universe, and that is interchangeable with energy.
Molecule	The smallest particle of a substance that retains all the properties of the substance and is composed of one or more atoms.
Natural selection	The principle that in a given environment individuals having characteristics that aid survival will produce more offspring, and the proportion of individuals having such characteristics will increase with each succeeding generation.
Organic	Compounds containing carbon and chiefly or ultimately of biological origin.
Photosynthesis	The chemical process by which chlorophyll-containing plants use light to convert carbon dioxide and water into carbohydrates, releasing oxygen as a by product.
Potential energy	The energy that matter has because of its position or because of the arrangement of atoms or parts.
Qualitative	Involving quality or kind.
Quantitative	Involving the measurement of quantity or amount.
Respiration	The physical and chemical processes by which an organism supplies its cells and tissues with the oxygen needed for metabolism and relieves them of the carbon dioxide formed in energy-producing reactions.
Scientific method	Principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses.
Variable	A quantity that may assume any one of a set of values.



Student Name _____

OHIO GRADUATION TESTS



Science

Spring 2009

This test was originally administered to students in March 2009. This publicly released material is appropriate for use by Ohio teachers in instructional settings. This test is aligned with Ohio's Academic Content Standards.

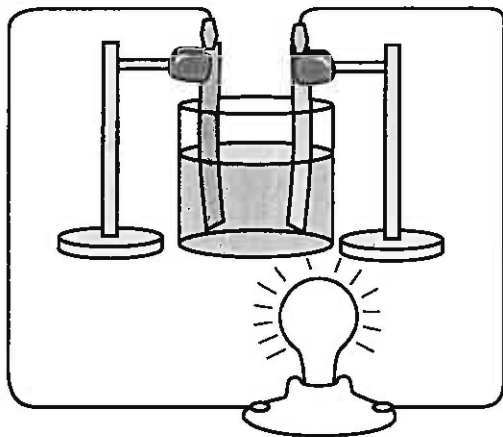
SCIENCE TEST

Directions: For multiple-choice questions, choose the correct answer and then mark the corresponding circle in the Answer Document. If you change an answer, be sure to erase the first mark completely.

Short-answer questions are worth two points. Extended-response questions are worth four points. Point values are printed near each question in your Test Booklet. The amount of gridded space provided for your answer is the same for all two- and four-point questions. Using the gridded space may or may not be necessary to answer the question; however, your response should be written in the gridded space.

Make sure the number of the question in this Test Booklet corresponds to the number on the Answer Document. Be sure to answer the question completely and show all your work in the Answer Document.

1. Strips of two different metals are placed in a solution of acid as shown in the picture below.



What indicates that ions are being formed?

- A. The solution becomes less acidic.
- B. The metal strips begin to swell up.
- C. An odor is emitted by the acid solution.
- D. An electrical current is present between the metal strips.

2. Mosquitoes carry malaria and other diseases. In order to control mosquito populations, a powerful pesticide called DDT was used for many years. DDT entered lakes, ponds, and rivers and accumulated in the tissues of fish. When birds, such as eagles, consumed the fish, they produced eggs with very thin shells. The thin-shelled eggs broke when the parents sat on them and the populations of eagles and other birds suffered. The U.S. government banned the use of DDT in 1972.

How did the banning of DDT most likely affect the population of bald eagles in the United States?

- A. The eagle population rapidly declined after the banning of DDT.
- B. The eagle population was not affected by the banning of DDT.
- C. The eagle population slowly increased after the banning of DDT.
- D. The eagle population increased and then rapidly decreased after the banning of DDT.

3. If you were working for the Center for Disease Control and discovered a new, highly dangerous pathogen, what information should be presented to the public that may prevent a widespread epidemic of the disease?

- A. the fatality rate caused by the pathogen
- B. a report on how the pathogen is transmitted from one organism to another
- C. pictures showing microscopic images of the pathogen so they will be familiar with it
- D. a description of the surface receptors found on the pathogen and the immune response

4. Jackie used a portable electric drill to remove screws from a broken wooden table. He noticed that the screws holding the table together were warm to the touch after being removed from the wood.

What explains this phenomenon?

- A. Mechanical energy from the drill was converted into thermal energy due to friction.
- B. Electrical energy from the drill was converted into chemical energy due to resistance.
- C. Thermal energy from the drill was converted into mechanical energy due to inertia.
- D. The process of removing the screw concentrated the thermal energy that was already present in the wood.

5. What structure is absent in the cells of fungi thereby preventing them from performing photosynthesis?

- A. cilia
- B. nuclei
- C. chloroplasts
- D. mitochondria

6. State two factors and explain how each influences the weather in Ohio.

Respond in the space provided in your **Answer Document**. (4 points)

On the March 2009 Ohio Graduation Science Test, questions 7-12 are field test questions that are not released.

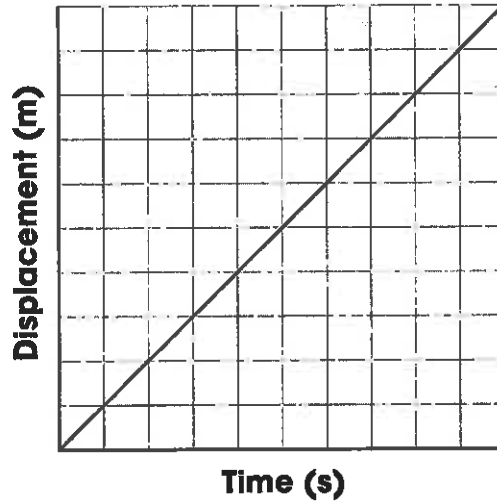
13. Rising ocean temperatures can cause corals to expel the symbiotic algae on which they depend for survival.

Which human influence could be responsible for an increase in this phenomenon?

- A. shoreline erosion
- B. burning fossil fuels
- C. solar power generation
- D. introduction of non-native species

14. A student records the position of a car every second for a period of time and plots the following displacement and time graph.

Displacement vs. Time



Illustrated below is the change in position of a car every second. Which observation of an object moving from left to right did the student record?

Position of a Car



Position of a Car



Position of a Car

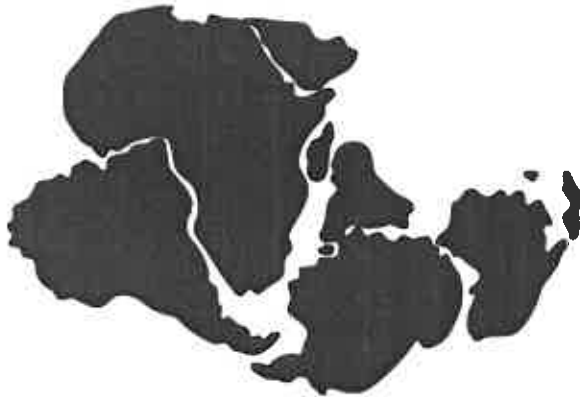


Position of a Car



15. Scientists have hypothesized for years that Earth's continents once formed a single landmass that broke apart and became the continents as we know them today. The model below shows the landmasses (Gondwanaland) as they started to break apart to form South America, Africa, Antarctica, India, and Australia.

Gondwanaland



What evidence best supports the model proposed above?

- A. Igneous rocks have been found on all the continents.
- B. Similar fossils have been found in parts of Africa and South America.
- C. Australia has marsupial species that are not found on other continents.
- D. Indications of sea level changes have been recorded on all the continents.

16. A student walks from inside an air-conditioned building to stand outside on a sunny, sandy beach. The student says that her face and the bottoms of her feet feel warm.

Which statement best describes the thermal energy transfer taking place?

- A. Thermal energy is transferred to her face by radiation, and thermal energy is transferred to the bottoms of her feet by radiation.
- B. Thermal energy is transferred to her face by convection, and thermal energy is transferred to the bottoms of her feet by radiation.
- C. Thermal energy is transferred to her face by radiation, and thermal energy is transferred to the bottoms of her feet by conduction.
- D. Thermal energy is transferred to her face by conduction, and thermal energy is transferred to the bottoms of her feet by conduction.

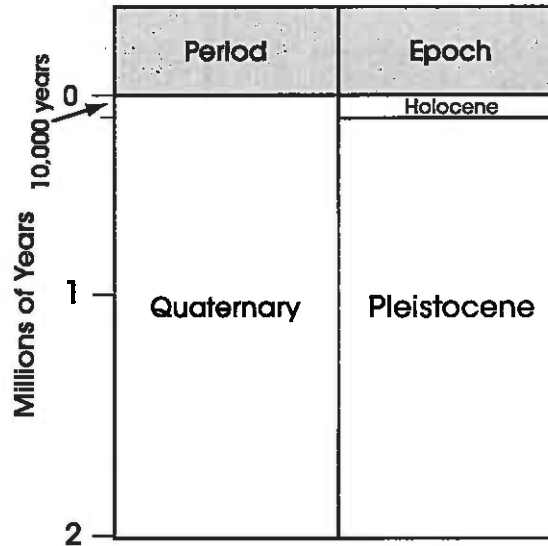
Use the tables to answer question 17.

Table A
Half-Lives

Radioactive Isotope	Half-life
Potassium 40	1.25 by
Rubidium 87	48.8 by
Thorium 232	14 by
Uranium 238	4.47 by
Uranium 235	704 my
Carbon 14	5,730 yrs

by = billions of years
my = millions of years

Table B
Partial Cenozoic Time Scale



17. Which isotope from Table A is the only one with applications for dating Holocene materials?

- A. carbon 14
- B. rubidium 87
- C. uranium 238
- D. potassium 40

18. Companies seeking new drug approval are required to conduct clinical trials involving human volunteers. During these trials, people with the disease are separated into different groups. One group receives a placebo (an inert or harmless substance used in controlled experiments). Each of the remaining groups receives a different dose of the drug (i.e., Group A receives a 30 mg dose once a day, Group B receives a 50 mg dose once a day, etc.).

Describe two reasons for testing new drugs at varying doses.

Respond in the space provided in your **Answer Document**. (2 points)

19. Some coal-burning power plants install "chemical scrubbers". These scrubbers reduce the amount of sulfur dioxide (SO_2) that is released when coal is burned.

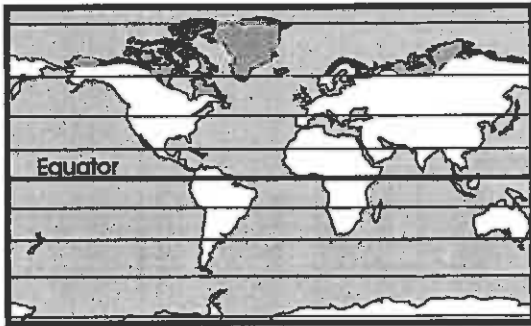
How does installation of these scrubbers benefit the environment?

- A. reduce the amount of acid rain
- B. reduce the amount of coal mined
- C. increase the amount of atmospheric CO_2
- D. increase the amount of ground level ozone

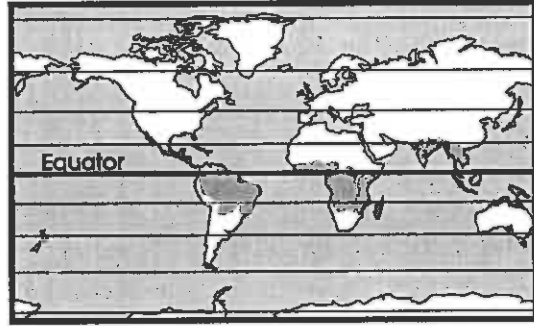
20. Color blindness is a sex-linked trait that is carried on the X chromosome. If a boy is born color-blind, what would have to be true?
- A. His father had normal vision.
 - B. His grandmother was color-blind.
 - C. His mother carried at least one gene for color blindness.
 - D. His grandfather passed on the color-blind trait to his father.

21. On which map do the shaded land areas represent regions where the average annual temperature is greater than 18°C (64.4°F)?

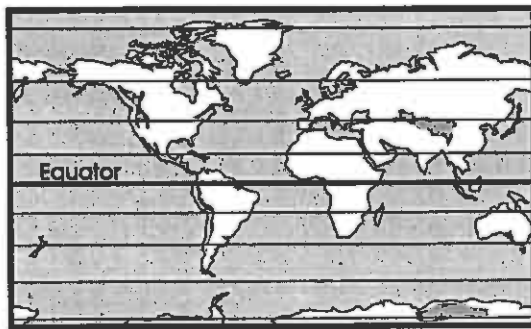
A.



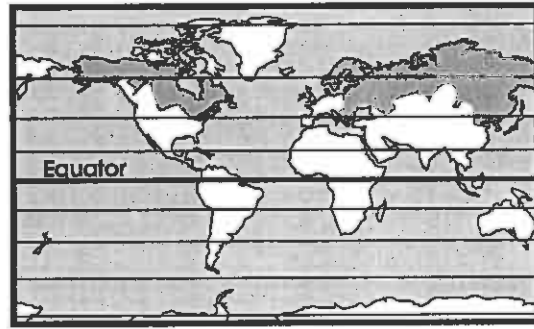
B.



C.



D.



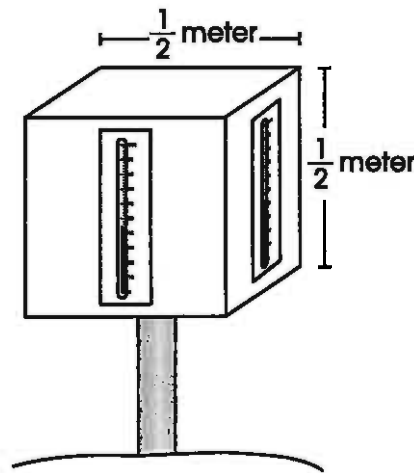
22. Solid copper wire is a good conductor because
- A. copper contains no protons.
 - B. electrons move easily within the wire.
 - C. protons and electrons tend to cluster at opposite ends of it.
 - D. copper contains the same number of protons and neutrons.

Use the information and illustration to answer questions 23 and 24.

Solar Warming

A group of students in Ohio conducted an investigation during the month of January to study the effects of solar warming. The students used a wooden box painted white. The box was mounted on a post in an open area and a thermometer was fastened on each of the four sides. The box was oriented so that each thermometer faced squarely in a different direction: north, south, east or west. The temperature on each thermometer was recorded in degrees Fahrenheit at 12:00 noon during five consecutive days of clear skies.

The picture shows the apparatus used by the students.



The table shows the data collected by the students.

**Effects of Solar Warming
(Temperature in °F)**

	North	South	East	West
Day 1	29	36	32	32
Day 2	29	36	32	31
Day 3	30	37	34	33
Day 4	27	34	32	30
Day 5	30	37	35	33

23. Based on the data, which statement best summarizes the effects of solar warming in January?
- A. Solar warming at noon is greatest on south-facing surfaces.
 - B. Solar warming is greatest in January when the weather is clear.
 - C. Solar warming in Ohio is greatest in the northern part of the state.
 - D. Solar warming increases from the west side of Ohio to the east side of Ohio.
24. When designing the investigation, one student suggested painting the wooden box black. Predict how painting the box black would affect the temperature readings from the four thermometers. Explain your reasoning.

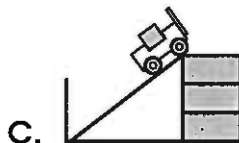
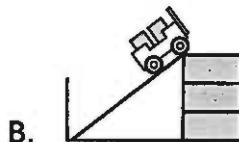
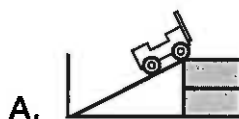
Respond in the space provided in your **Answer Document**. (2 points)

25. A student is studying several species that belong to the plant kingdom. Which two are most closely related?

- A. *Ficus benjamina* and *Ficus lyrata*
- B. *Castilla elastica* and *Ficus elastica*
- C. *Bromus japonicus* and *Ipomoea violacea*
- D. *Fernaldia pandurata* and *Ficus pandurata*

26. All carts shown below are identical 0.5 kilogram metal carts. Blocks placed in the carts have a mass of 1 kilogram each.

Which cart arrangement has the greatest amount of gravitational potential energy with the cart sitting at the top of the ramp as shown in each diagram?



27. An aquatic ecologist collects data about the water quality of an Ohio lake throughout the year. In the summer, the ecologist shares data with a public health official from a nearby town.

Which data would a public health official use to determine whether the water was safe for swimming?

- A. the temperature of the surface water
- B. the amount of dissolved oxygen in the deep water
- C. the number of water lilies, *N. odorata*, growing in the lake
- D. the concentration of *E. coli* bacteria near the surface of the lake

28. Scientists and engineers from The Society of Automotive Engineers (SAE) and National Transportation and Safety Board (NTSB) conduct studies and develop technical guidelines for designers and manufacturers of consumer products. Such guidelines have made possible the development or improvement of collision avoidance systems, passenger and pedestrian safety systems, and safer automotive power and fuel systems.

Which statement accurately describes a positive effect on science and society from studies and guidelines developed by the SAE and NTSB?

- A. SAE and NTSB guidelines are permanent.
- B. SAE and NTSB help scientists and engineers decide how the products will be marketed.
- C. Scientific studies provide the data SAE and NTSB use to develop the guidelines for design standards that scientists and engineers follow.
- D. SAE and NTSB studies and guidelines are used to protect the trademarks, copyrights and patents that scientists and engineers receive on their inventions.

Science

29. Most bacteria reproduce asexually. Mammals reproduce sexually. Describe how these two methods of reproduction differ with respect to the genetic makeup of the offspring produced.

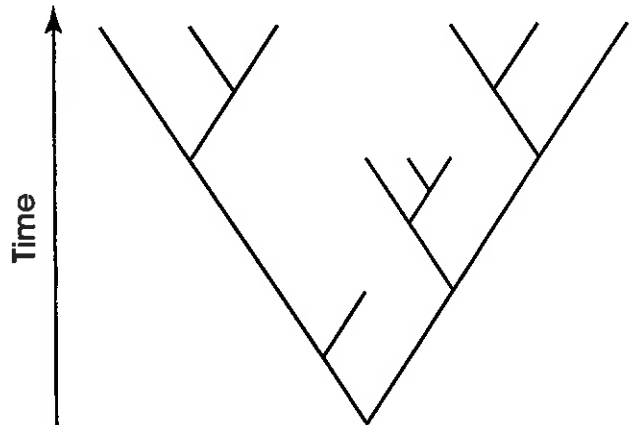
Respond in the space provided in your **Answer Document**. (2 points)

30. An oceanographer is traveling from the west toward the east on the Atlantic Ocean. She collects rock samples from the seafloor every 5 kilometers. The oceanographer stops when she determines that the rock samples are getting progressively younger as she moves toward the east.

What conclusion is best supported by this data?

- A. She is traveling toward a mid-ocean ridge.
- B. She is traveling toward a deep-ocean trench.
- C. She is traveling away from an underwater volcano.
- D. She is traveling away from a hot spot in the crust.

31. The following diagram is found in an evolutionary biology textbook.



This branching tree diagram is most likely used to represent the theory that suggests

- A. new species arise throughout time following rounds of mass extinction.
- B. all species share a common ancestor and that change occurs through time.
- C. speciation occurs very quickly with long periods of no change in between.
- D. all species originated during the same period and some have subsequently gone extinct.

32. Light travels in air at approximately 3.0×10^8 m/s. When it enters a glass window, this speed is reduced to about 2.0×10^8 m/s. When the light re-enters the air, what will the speed of light be?

- A. 2.0×10^8 m/s
- B. 2.5×10^8 m/s
- C. 3.0×10^8 m/s
- D. 5.0×10^8 m/s

33. A student has set up an artificial ecosystem for a class project. This ecosystem has producers, first-level consumers, second-level consumers, and third-level consumers. By accident, a chemical enters the ecosystem and kills all of the first-level consumers.

Which group(s) of organisms will most likely survive?

- A. producers
- B. second-level consumers
- C. second-level and third-level consumers
- D. third-level consumers and producers

34. An astronomer investigating a star determines that the light wavelengths she observes are longer than those expected to be emitted by the star.

What can be concluded about the motion of the star relative to Earth's position?

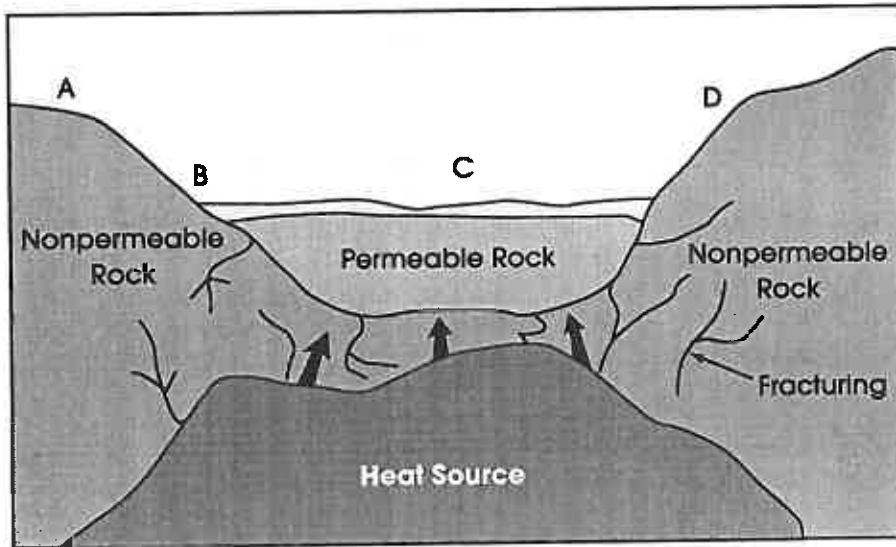
- A. The star is moving closer to Earth.
- B. The star is moving away from Earth.
- C. The star is accelerating faster than Earth.
- D. The star is accelerating at the same speed as Earth.

35. A teacher gives a student a non-toxic, odorless, white powder to identify. Generate four questions, each regarding a different property of the unknown powder, that could be safely tested and answered in the laboratory.

Respond in the space provided in your **Answer Document**. (4 points)

Use the diagram below to answer question 36.

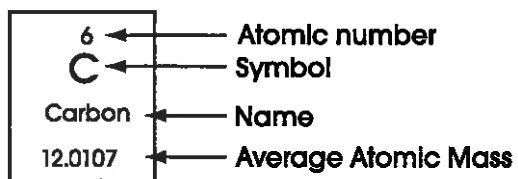
Cross Section of an Area of Earth's Crust



36. In which area of the diagram above is a geyser most likely to form?

- A. A
- B. B
- C. C
- D. D

Use the diagram to answer question 37.



37. The atomic number of carbon is 6, which means that carbon atoms always have 6
- A. ions.
 - B. protons.
 - C. neutrons.
 - D. valence electrons.

38. An earth science teacher places four pieces of carpet padding, representing sedimentary layers, between two large book ends, as shown in Figure 1. She then pushes the book ends toward each other, as shown in Figure 2.

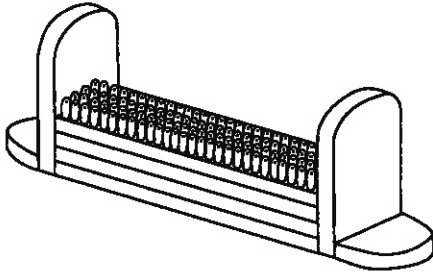


Figure 1

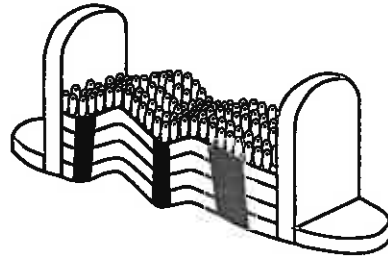
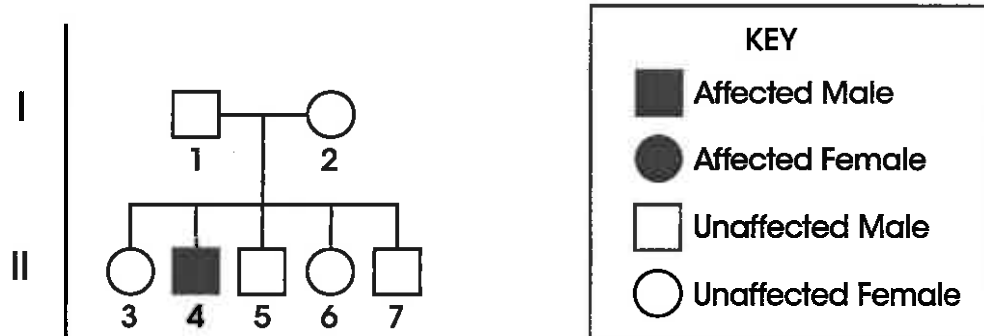


Figure 2

What geologic process has the teacher demonstrated?

- A. folding
- B. faulting
- C. convection
- D. divergence

39. The pedigree below shows the inheritance pattern of a recessive allele (z) that results in a genetic disease.



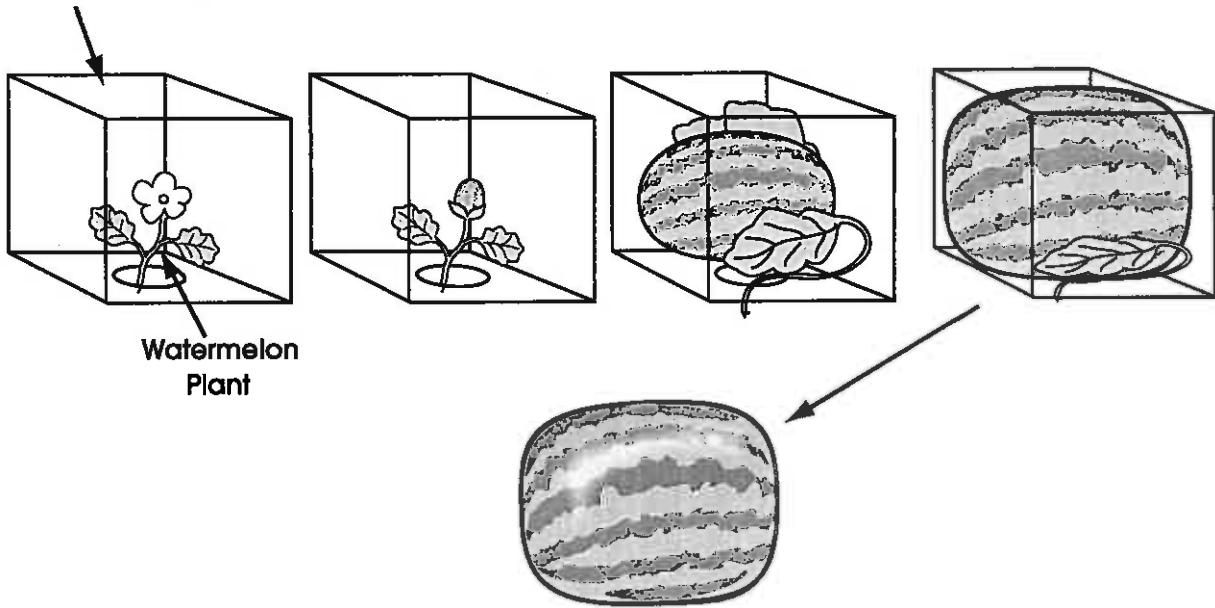
Based on the inheritance pattern, what are all the possible genotypes for individual 6?

- A. Zz
- B. ZZ and zz
- C. ZZ and Zz
- D. ZZ, Zz and zz

Science

40. In a recent agricultural experiment, farmers in Japan inserted fertilized watermelon blooms into square containers, which resulted in the fruit taking the shape of its container as it grew.

Clear container



Describe two benefits of farming practices that produce square watermelons.
Respond in the space provided in your **Answer Document**. (2 points)

41. Geneticists have determined that the majority of individuals in an isolated island population have blood type B. Type A blood is found to be more common in the mainland population from which the island was settled.

How could a geneticist best explain the dominance of blood type B in the island population?

- A. Random mutations have occurred in the island population.
- B. Genetic drift has reduced the frequency of type A individuals.
- C. Natural selection has only occurred in the mainland population.
- D. Environmental conditions on the island are less favorable for type B individuals.

42. Graphite and diamond are both forms of pure carbon. Graphite is soft and grey while diamond is hard and transparent. The physical properties of graphite and diamond differ due to

- A. the charge of their electrons.
- B. their average kinetic energy.
- C. the bonds between their atoms.
- D. the number of neutrons in their nuclei.

43. The White Cliffs of Dover are made of a white sedimentary stone called chalk, which was formed when shells and skeletons of small marine organisms were deposited in a thick layer.

An examination of the Cliffs of Dover from top to bottom would show a change from

- A. younger fossils to older fossils.
- B. simple fossils to complex fossils.
- C. igneous rock to sedimentary rock.
- D. marine organisms to land organisms.

44. Due to a loss of habitat, hunting, drought, disease, and inbreeding, the cheetah population has declined in number and is close to extinction. The current cheetah population has very little genetic variation.

Which is a result of the limited genetic variation in the current cheetah population compared to earlier cheetah populations with more variation?

- A. Current populations of cheetahs are more resistant to diseases.
- B. The survival rate of young cheetahs is increased in current populations.
- C. Current populations of cheetahs are less likely to be able to adapt to environmental changes.
- D. Current populations of cheetahs are able to interbreed with other species, increasing genetic variation.

**Spring 2009 Ohio Graduation Tests (OGT)
Science Answer Key**

Question Number	Type	Content Standard	Content Standard Benchmark	Answer Key
1	Multiple Choice	Physical Sciences	A	D
2	Multiple Choice	Life Sciences	G	C
3	Multiple Choice	Scientific Ways of Knowing	D	B
4	Multiple Choice	Physical Sciences	F	A
5	Multiple Choice	Life Sciences	A	C
6	Extended Response	Earth and Space Sciences	B	E
7	Multiple Choice	Not Released		
8	Multiple Choice	Not Released		
9	Multiple Choice	Not Released		
10	Multiple Choice	Not Released		
11	Short Answer	Not Released		
12	Multiple Choice	Not Released		
13	Multiple Choice	Life Sciences	G	B
14	Multiple Choice	Physical Sciences	D	A
15	Multiple Choice	Earth and Space Sciences	C	B
16	Multiple Choice	Physical Sciences	F	C
17	Multiple Choice	Earth and Space Sciences	C	A
18	Short Answer	Scientific Ways of Knowing	C	S
19	Multiple Choice	Science and Technology	B	A
20	Multiple Choice	Life Sciences	C	C
21	Multiple Choice	Earth and Space Sciences	B	B
22	Multiple Choice	Physical Sciences	C	B
23	Multiple Choice	Scientific Inquiry	A	A
24	Short Answer	Physical Sciences	G	S
25	Multiple Choice	Life Sciences	E	A
26	Multiple Choice	Physical Sciences	E	B
27	Multiple Choice	Scientific Ways of Knowing	A	D
28	Multiple Choice	Physical Sciences	H	C
29	Short Answer	Life Sciences	C	S
30	Multiple Choice	Earth and Space Sciences	E	A
31	Multiple Choice	Life Sciences	I	B
32	Multiple Choice	Physical Sciences	G	C
33	Multiple Choice	Life Sciences	F	A
34	Multiple Choice	Earth and Space Sciences	A	B
35	Extended Response	Scientific Inquiry	A	E
36	Multiple Choice	Earth and Space Sciences	E	C
37	Multiple Choice	Physical Sciences	A	B
38	Multiple Choice	Earth and Space Sciences	E	A
39	Multiple Choice	Life Sciences	C	C
40	Short Answer	Science and Technology	B	S
41	Multiple Choice	Life Sciences	I	B
42	Multiple Choice	Physical Sciences	C	C
43	Multiple Choice	Earth and Space Sciences	C	A
44	Multiple Choice	Life Sciences	H	C