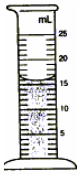
2008 Midterm Exam Review Answers

Mr. Trulsson's 7th Grade Science

1. **What piece of lab safety equipment should be worn when there is the possibility of harmful chemicals splashing in your eyes?** Safety goggles.
2. **What safety procedure should always be followed for every experiment?** Follow the teacher's directions, and do not do anything that the teacher did not direct you to do.
3. **What should be done with long hair when working in the lab?** Long hair should be kept tied back.
4. **Draw and label the following pieces of lab equipment:**

Beaker

Petri Dish



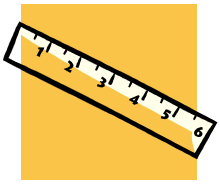
Graduated Cylinder

Flask

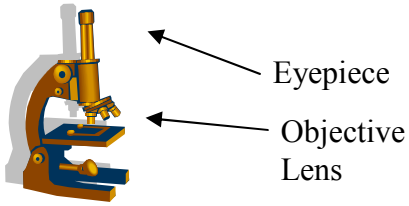
Triple-Beam Balance

Test Tube

Eye Dropper



Ruler



Microscope

5. **What is the first thing that should be done when there is an accident in the laboratory?** If the accident involves getting a chemical in a person's eye, the first thing done should be to wash out the chemical at the eye wash station. For any other kind of accident, including spilled chemicals and broken glassware, inform the teacher immediately, and keep yourself and others away from the accident.
6. **What lab equipment would you use to measure 50mL of water?** A 50mL or 100mL graduated cylinder.
7. **What should hot glassware be handled with?** Tongs or heat resistant (insulated) gloves.
8. **What is the first lab safety procedure you should follow when you receive the lab experiment instructions?** Read completely through all of the steps in the experiment. If you do not understand any part of the written procedures, ask the teacher for further explanation.
9. **Why are safety goggles one of the most important pieces of lab equipment?** Safety goggles are the most important piece of lab safety equipment because your eyes are the most sensitive and most easily damaged organs of your body. You can be blinded with just a few seconds' exposure to a strong acid or base.
10. **Draw a flow map of the scientific method. Below the flow map give a brief description of each step.**
    1. Problem Identification: the question to be answered by the experiment.
    2. Literature Review: research to find the likely answer to the problem.
    3. Hypothesis: an educated guess or prediction about the answer to the problem.
    4. Experimental Design: a list of materials needed to perform the experiment, with sizes and quantities, and a numbered list of steps (procedures) to be followed in the experiment.

5. Data Collection: perform the experiment, following the experimental design, and record qualitative and quantitative data.
6. Data Analysis: prepare charts and graphs to explain and analyze the data.
7. Conclusion: state whether the hypothesis is accepted or rejected, and give opinions about the results of the experiment, including sources of error and ways to improve the experiment.

11. **For the following lab experiment use the terms below to identify each step of the Scientific Method: *"Put the Duracell battery into the flashlight and turn the flashlight on. When that battery runs out of power, change out the battery and put the Energizer battery into the flashlight and turn it on."*** Experimental Design (Procedures).
12. **For the following lab experiment use the terms below to identify each step of the Scientific Method: *"Record how long each battery lasted into your log book."*** Data Collection.
13. **For the following lab experiment use the terms below to identify each step of the Scientific Method: *"After performing the experiment the Energizer lasts longer than the Duracell battery."*** Conclusion.
14. **For the following lab experiment use the terms below to identify each step of the Scientific Method: *"Which battery will last longer when being used: Energizer or Duracell?"*** Problem.
15. **For the following lab experiment use the terms below to identify each step of the Scientific Method: *"The Energizer battery will last longer because it was more expensive."*** Hypothesis.
16. **Define matter.** Matter is anything that has mass and takes up space. Mass is a measurement of how much matter is contained in an object.
17. **What is the measure of how much space something takes up?** Volume.
18. **What are the basic metric units for length, volume and mass?** Length: meters (m). Volume: liters (L) for liquids and cubic meters (m^3) for solids. Mass: grams (g) or kilograms (kg).
19. **Give three examples of a physical property.** Examples of physical properties include size, mass, density, hardness, viscosity, color, texture, boiling point and melting point.
20. **Give three examples of a chemical property.** Examples of chemical properties include the reactivity of sodium with water (the ability to form sodium hydroxide and hydrogen), the reactivity of iron with oxygen (the ability to rust), and the reactivity of gasoline with oxygen (the flammability or ability of gasoline to burn).
21. **What is the difference between a physical and a chemical change?** A chemical change results in a new substance-chemically different from what you started with. A physical change just changes the form or appearance of the substance *without* making a different substance.
22. **List three physical changes.** Tearing paper, chopping wood, melting ice into liquid water.
22. **List three chemical changes.** Rusting iron: $4Fe + 3O_2 \rightarrow 2Fe_2O_3$;
Sodium – Water: $2Na + 2H_2O \rightarrow 2NaOH + H_2$; Burning hydrogen: $2H_2 + O_2 \rightarrow 2H_20$.
23. **What is photosynthesis?** Photosynthesis is the process used by plants to covert electromagnetic energy from the Sun into chemical energy stored in the atomic bonds in sugar molecules.
24. **What are the reactants (needed ingredients) of photosynthesis?** The reactants for photosynthesis are carbon dioxide (CO_2) and water (H_2O). Reactants are shown on the left side of the chemical equation: $6CO_2 + 6H_20 \rightarrow C_6H_{12}O_6 + 6O_2$.
25. **What are the products (produced substances) of photosynthesis?** The products for photosynthesis are sugar ($C_6H_{12}O_6$) and oxygen (O_2). Products are shown on the right side of the chemical equation: $6CO_2 + 6H_20 \rightarrow C_6H_{12}O_6 + 6O_2$.
26. **What sugar is made in photosynthesis?** Most plants make a simple form of sugar called glucose ($C_6H_{12}O_6$), though other plants make different kinds of sugar.

27. **What does the atomic number tell you about an atom?** The atomic number of a element is the number of protons that an atom of that element has. Atoms usually have the same number of protons and electrons, so the atomic number also indicates the number of electrons.
28. **How is the periodic table arranged?** The periodic table is arranged in order of increasing atomic number, from top to bottom and left to right (like the words in a book). Hydrogen, with an atomic number of 1, is at the upper left corner, and the element with the highest atomic number is located at the bottom right end of the table.
29. **Are the elements F, Cl, Br, and I in the same period or family/group?** The elements fluorine (F), chlorine (Cl), bromine (Br) and iodine (I) are all part of group 17, the halogen family or group. Groups or families are vertical columns on the periodic table. Periods are horizontal rows on the periodic table.
30. **Where on the Periodic Table are metals, nonmetals, and metalloids located?** The dark, zig-zag line near the right side of the periodic table is the dividing line between metals, metalloids and non-metals. Those elements touching the zig-zag line (except aluminum) are metalloids. Elements to the right of the metalloids are non-metals. Elements to the left of the metalloids are metals (except hydrogen, which is a non-metal).
31. **What are atoms?** An atom is the smallest piece of an element that retains the properties of that element. When you split an atom into still smaller sub-atomic particles (protons, neutrons and electrons), it no longer is an element.
32. **How many different elements are in the chemical formula H_2SO_4?** There are three different elements in sulfuric acid, H_2SO_4, hydrogen (H), sulfur (S) and oxygen (O). Element symbols may contain either one or two letters, but will always begin with a capital letter. If there is a second letter in the element symbol, it will be lower case. Count the capital letters to find the number of different elements in a formula. Note that this question is <u>not</u> asking how many atoms are in one molecule of H_2SO_4.
33. **How many atoms of sulfur are in H_2SO_4?** There is only one atom of sulfur (S) in H_2SO_4, because there is no subscript number to the right of the symbol for sulfur (S). When a symbol appears in a chemical formula without a subscript number behind it, it means there is only one atom of that element. (There are two atoms of hydrogen, and four atoms of oxygen in H_2SO_4).
34. **Write an example of a chemical formula.** Examples of chemical formulas include: H_2O (water); CO_2 (carbon dioxide); $C_6H_{12}O_6$ (glucose); H_2SO_4 (sulfuric acid); HCl (hydrochloric acid); $NaHCO_3$ (sodium bicarbonate – baking soda); NaOH (sodium hydroxide).
35. **How many elements did you list in your chemical formula on #34?** H_2O (2; hydrogen, oxygen); CO_2 (2; carbon, oxygen); $C_6H_{12}O_6$ (3; carbon, hydrogen, oxygen); H_2SO_4 (3; hydrogen, sulfur, oxygen); HCl (2; hydrogen, chlorine); $NaHCO_3$ (4; sodium, hydrogen, carbon, oxygen); NaOH (3; sodium, oxygen, hydrogen).
36. **What is the law of conservation of energy?** Energy cannot be created or destroyed; it can only change forms.
37. **Where does all energy on Earth come from?** Most of the energy on Earth originally came from the Sun, where it was created in the nuclear fusion reaction in the Sun's core, and traveled to Earth as electromagnetic energy. Some of this energy created the oil and natural gas we use today as our primary fuels. A small amount of Earth's energy comes from the decay (fission) of radioactive elements in the Earth's core. This reaches the Earth's surface in the form of volcanoes and tectonic plate movement.
38. **What are the six forms of Energy? Give examples of each form of energy.** 1) <u>Nuclear</u>: fusion reaction in Sun's core; 2) <u>Electromagnetic</u>: light from the Sun; 3) <u>Chemical</u>: energy contained in atomic bonds of glucose molecule; 4) <u>Mechanical</u>: moving wind and water; 5) <u>Electrical</u>: moving electrons in electrical wires; 6) <u>Thermal</u>: vibrating atoms and molecules, felt as "heat" by humans.

39. **What is kinetic energy?** Kinetic energy is a type of energy that is presently doing work, usually by creating motion which appears in one of four energy forms: When the motion is in a large object, it is mechanical energy. When the motion is in electrons, it is electrical energy. When the motion is vibrating atoms, it is thermal energy. When the motion is in electromagnetic waves, it is electromagnetic energy.

40. **What is potential energy?** Potential energy is stored energy, not presently doing work. The main types of potential energy are in the form of mechanical energy (see next question). Potential energy can also be stored in molecules as chemical energy, and in the nucleus of radioactive elements as nuclear energy.

41. **What are the two types of potential (mechanical) energy. Give an example of each.** The two main types of potential mechanical energy are gravitational and elastic. In gravitational potential energy, the energy is stored in an object by lifting it above the Earth's surface, so that the energy can be turned into kinetic mechanical energy as the object falls. In elastic potential energy, energy is stored as stress, such as in a stretched rubber band or compressed spring

42. **Flow Map the following energy conversions (transfer) using the 6 forms of energy:**
    a. ***Rubbing your hands together on a cold day.*** Mechanical → Thermal. Moving your hands back and forth to rub them together is mechanical energy. Some of that energy is converted to thermal energy (heat) because of friction.
    b. ***Photosynthesis.*** Nuclear → Electromagnetic → Chemical → Mechanical. The Sun originally gets its energy from a nuclear fusion reaction, which is converted to electromagnetic energy (sunlight) that reaches Earth. Plants use the electromagnetic energy to make glucose, which contains stored chemical energy, and use the glucose to grow (mechanical energy).
    c. ***Turning on a flashlight.*** Mechanical → Chemical → Electrical → Electromagnetic / Thermal. The movement of the flashlight switch (mechanical) allows the energy stored in the battery (chemical) to be converted into electricity (electrical) which powers the light bulb (electromagnetic and thermal) or LED (just electromagnetic).

43. **What is a nonrenewable resource and give an example?** A nonrenewable resource is a substance found on Earth in limited quantities that could be completely used up. Examples of nonrenewable energy resources are coal, oil, uranium and natural gas. Once these energy resources are used up, we will have to depend only on renewable and inexhaustible energy resources.

44. **What is a renewable resource and give an example?** A renewable resource is a substance found on Earth that can be continually re-grown, though only in limited quantities. Examples of renewable energy resources are wood, alcohol created by the fermentation of plant material, food for animals, and methane created by the decay of plant material. These energy sources can be renewed each year through planting and processing.

45. **What is an inexhaustible energy resource? Give an example.** An inexhaustible energy resource is any source of energy that flows directly and immediately from sunlight reaching Earth, planetary movement or radioactive decay within the Earth's core. Examples are energy converted from sunlight, wind action, tidal action, wave action and heat in the Earth's core (geothermal). Though continuously replenished, all of these sources are limited for a given period of time.

46. **What is force?** Force is a push or a pull. It can either be a contact force, like a collision between two cars, or a long-range force, like gravity or magnetism.

47. **What is Newton's First Law of Motion?** Newton's First Law of Motion states that "An object at rest stays at rest, and an object in motion stays in motion at a constant velocity, unless acted upon by an unbalanced force." It other words, an object will stay still unless some force makes it move, and will keep moving unless some force makes it stop moving.

48. **Define inertia**. Inertia is the tendency of an object to resist a change in its motion. The amount of inertia that an object has is directly related to its mass—the more mass, the more inertia. Inertia is what makes a person who is not wearing a seat belt be thrown through the windshield when the car he is riding in suddenly stops.

49. **What is net force?** Net force is the overall force acting on an object. It is found by adding all of the forces acting on an object together, with consideration given to the direction of the forces. For example, two forces of equal strength coming from opposite directions will cancel out one another, giving a net force of zero. Two equal forces coming from the same direction will give a net force of twice that of each individual force.

50. **What is the net force if a person pushes on a box with a force of 8N to the left and another person pushes on the same box with a force of 4N to the right?** The net force will be 4N to the left. The opposing force of 4N to the right cancelled out half (4N) of the left acting force, leaving 4N of force to the left.

51. **List 6 simple machines. Give examples of each.** 1) Inclined Plane: handicap ramp at building entrance; 2) Screw: jar lid, wood screw, drill bit; 3) Pulley: crane winch, flag pole rope, block & tackle; 4) Lever: wheelbarrow, see-saw, pry bar, rake; 5) Wedge: axe, teeth, knife; 6) Wheel & Axle: handle on pencil sharpener, wheels on car, door knob, wheelchair wheels.

52. **Draw an illustration of the following levers: scissors, door, hockey stick. Label the class of lever, input, output, and fulcrum of each.**
    a. **Scissors**: first class lever, with center pivot as fulcrum, handles as input arm, and cutting edges as output arm.
    b. **Door**: second class lever, with hinges as fulcrum, doorknob as input arm, and door itself as output arm.
    c. **Hockey Stick**: third class lever, with end of stick nearest to body as fulcrum, middle of stick (where held in hand) as input arm, and end of stick where puck hit as output arm.

53. **What is a fulcrum?** A fulcrum is the pivot point on a lever, such as the center support on a see-saw, or wheel on a wheelbarrow, or hinge on a door.

54. **What is a pulley? Give an example.** A pulley is a grooved wheel or wheels with a rope, cable or chain wrapped around the wheels. It is used to magnify the input force to lift heavy objects. An example of a pulley is the winch on a crane.

55. **What does rotation cause and how long does it take for the earth to rotate one time?** Rotation is the spinning of an object on its axis. The Earth rotates (spins) on its axis once every day. The Earth's rotation causes day and night, making it appear as if the Sun was moving across the sky.

56. **What causes seasons on the earth?** The Earth revolves (orbits) around the Sun once each year. Because the Earth's axis is tilted 23.5 degrees, the Northern Hemisphere is tilted towards the Sun for half of the year in spring and summer (from March 22nd to September 20th) and away from the Sun for half of the year in fall and winter (from September 22nd to March 20th). Summer occurs when the Sun is highest in the sky, and winter occurs when the Sun is lowest in the sky.

57. **If the Northern Hemisphere is pointed away from the Sun, what season is the Southern Hemisphere experiencing?** When the Northern Hemisphere is pointed away from the Sun, it is experiencing its winter. At the same time, the Southern Hemisphere is pointed towards the Sun, and is thus experiencing its summer.

Essay Questions (chose two of four):

1. **Thoroughly explain the photosynthesis process in plants. Include what is needed for photosynthesis, what is happening during photosynthesis, and what is produced.** Photosynthesis is the process used by green plants to capture the energy in sunlight (electromagnetic energy) and convert it to sugar (chemical energy) that can be stored and used by the plant to grow. The sunlight is captured by a pigment called chlorophyll that is found in organelles called chloroplasts, mostly in the leaves of the plants. The plant needs two ingredients (reactants) other than sunlight to complete the photosynthesis chemical reaction: carbon dioxide from the air, and water from the ground. The products of photosynthesis are glucose and oxygen. The chemical equation for photosynthesis is: $6CO_2 + 6H_20 \rightarrow C_6H_{12}O_6 + 6O_2$. Virtually all life on earth depends on photosynthesis for its food.
2. **List and explain the seven steps of the Scientific Method.** The first step of the scientific method is identification of a problem to be solved or question to be answered. For example, a problem might be to determine which battery brand, Eveready or Duracell, will last the longest. The second step of the scientific method is a literature review or research about the problem, with a goal of finding out the problem's answer, as determined by other scientists. This might be a Consumer Report test on batteries. The third step of the scientific method is forming a hypothesis, an educated guess of the answer to the problem or question, based on the literature review just performed. The hypothesis might be that "It is predicted that Duracell batteries will last longer than Eveready." The fourth step of the scientific method is designing the experiment, by listing out all of the materials needed and step-by-step procedures of the experiment. In performing the experiment, these steps will be followed exactly. The fifth step of the scientific method is actually performing the experiment and collecting the data. An example would be the actual times that each battery lasted in a flashlight. Multiple trials are needed to maximize accuracy. The sixth step is to analyze the data by averaging all the trials together, and preparing charts and graphs that show the result. The seventh and last step is to form conclusions, either accepting or rejecting the hypothesis, stating all sources of error, and giving opinions of what was learned in the experiment.
3. **Explain the two types of energy and give examples. Also explain the six forms of energy and give examples.** Energy can be classified into two main types: kinetic energy and potential energy. Kinetic energy is actually doing work, usually by causing motion of an object, particle or energy field. For example, kinetic energy would include a moving train, the vibrating molecules of its hot engine, the sound waves created by its whistle, the electromagnetic waves of its lights, and the moving electricity in its wires. Potential energy is stored energy not presently doing work. It includes the energy stored in objects because of their height above the ground (gravitational) and energy stored as stress, such as in a compressed spring or stretched rubber band (elastic). It also includes the energy stored in the oil the train burns as fuel, and in its batteries. The radioactive instability of some atomic nuclei is a form of potential energy. Energy can also be classified into six different forms: nuclear, electromagnetic, chemical, thermal, electrical and mechanical. Nuclear energy is the conversion of matter into energy, by either fusing two small atoms into one larger one, or the breaking apart (fission) of a large atom into a smaller one. Nuclear power plants use fission of uranium, while the Sun's core fuses hydrogen into helium. Electromagnetic energy, such as visible light, radio waves, ultraviolet light and x-rays, is the only form of energy that does not need matter to be transmitted. All of the energy from the Sun reaches the Earth through the vacuum of space as electromagnetic energy. Chemical energy is stored in the bonds between atoms in a molecule. Large molecules containing carbon and hydrogen (like sugar and gasoline) can store large amounts of energy in their carbon-hydrogen bonds. This energy is released as thermal and electromagnetic energy when the bonds are broken as the sugar or gasoline is burned. Thermal energy is the vibration

of atoms and molecules that we sense as heat. The hotter something is, the more thermal energy is has. Electrical energy is contained in moving electrons. Electrons are free to move between atoms in conductors (usually metals). Electrical energy is contained in lightning, and is generated by moving a coil of wire through a magnetic field in a electrical generator. Mechanical energy is the momentum (mass times velocity) contained in any moving object. The faster that something moves and the more mass it has, the greater the mechanical energy.

4. **Relate the hovercraft demonstration to Newton's First Law, inertia and mass, balanced forces, and unbalanced forces.** The hovercraft demonstrated Newton's First Law of Motion, which states that an object at rest will stay at rest and an object in motion will stay in motion unless acted upon by an unbalanced force, because it did not move until it was pushed by a teacher, and did not stop until the teacher at the other end of the hall (or friction) stopped it. A hovercraft is different from wheeled vehicles because it has very little friction. The faster that the hovercraft is pushed, and the more mass it contains (as in bigger students), the more inertia it will have and the longer it will coast before stopping. Also, the more inertia the hovercraft has, the harder it is for the teacher to stop it. Gravity pulling down and the air pushing the hovercraft up are two balanced forces that cancel each other out, causing the hovercraft to float. The unbalanced force is the push provided by the teacher to start it moving, and the push by the other teacher to stop the hovercraft.