

Physical Science DTAMS Assessment – Version 2
 Diagnostic Teacher Assessments in Mathematics and Science—Middle School

Date _____ Start time _____ Finish time _____

Please provide the following information about yourself:

Years teaching experience (0 if preservice) _____	Last 4 digits of Social Security number (or any 4-digit number you'll remember) _____ (used as identifier on score report)
Check grade level(s) currently teaching (or will be teaching if preservice). Mark one or more that best describes your situation. (please describe below if "other")	Check current (or future if preservice) teaching certificate grade level(s) . Mark one or more that best describes your situation. (please describe below if "other")
Number of college & graduate earth science courses _____	Number of college & graduate life science courses _____
Number of college & graduate physical science courses _____	Sex (M/F) _____
Content area of teaching certificate	
<p>Mark one or more that best describes your situation.</p> <p>If your certificate is a <u>general education certificate</u> that covers all subjects (e.g. as many elementary certificates do) but doesn't specifically include a separate science certification, please <u>mark "not science"</u>.</p> <p>If your certificate includes content areas in addition to science, please choose from the list on the right based on the science content portion only and <u>do not mark</u> the "not science" category.</p>	<p>not science _____</p> <p>general science _____</p> <p>biology/life science _____</p> <p>chemistry _____</p> <p>physics _____</p> <p>physical science _____</p> <p>earth science _____</p> <p>astronomy _____</p> <p>geology _____</p> <p>other science _____</p> <p>(please describe "other science")</p>

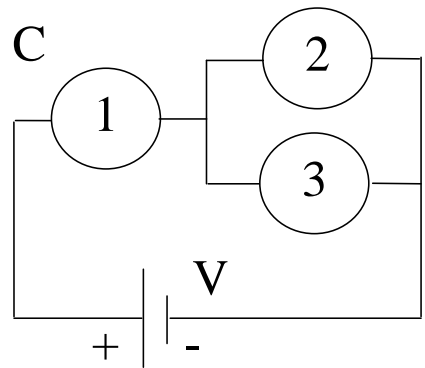
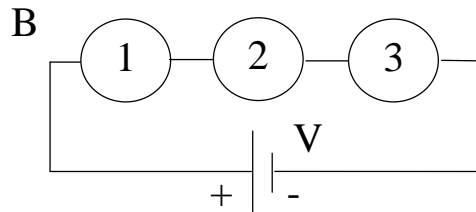
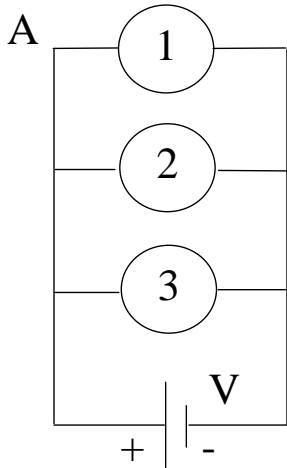
Multiple Choice

Identify and write in the space the letter of the choice that best completes the statement or answers the question.

- _____ 1. A teacher takes two identical steel ball bearings from a drawer and wraps one in thick fur, the other in a thin layer of tissue paper and places both of them back in the drawer. Which of the following would she expect to observe several hours later?
- The fur-wrapped steel ball bearing would be colder than the tissue paper-wrapped one because the fur retains the coolness of the steel longer than the tissue paper.
 - Both ball bearings would be significantly warmer than the room and about the same temperature as each other because any layer wrapped around steel is a good insulator.
 - They both would be the same temperature as when the experiment started because the ambient temperature isn't affected by the type of wrap.
 - The fur-wrapped steel ball bearing would be warmer than the tissue paper-wrapped one because fur acts as an insulator.
- _____ 2. As the result of modern technology we can now keep houses in the North warm during the winter and houses in the South cool during the summer. Both processes (heating houses in the North and cooling houses in the South) are more efficient if the houses have more insulation. Why then is it more of a savings to insulate a house in the North than in the South?
- Winter days are shorter on average in the North than in the South due to the angle of the sun relative to the earth.
 - Houses are heated with gas more often in the North than in the South because fuel prices are higher in the North.
 - The difference between the inside and outside temperatures is greater in the winter in a cold climate than it is in the summer in a hot climate.
 - There is more sunlight in a warm climate on average than in a cold climate due to the angle of the sun relative to the earth.
- _____ 3. In a darkened room, a student shined bright white light through a blue filter and onto a yellow object. Her results showed that the object appeared
- yellow because yellow objects always reflect that color.
 - blue because the object reflects the blue light.
 - green because blue and yellow mixed make green.
 - black because no light is reflected.
- _____ 4. A rifle is mounted perfectly horizontal 1.5 m above a large perfectly flat field. Simultaneously with the first bullet being fired out of the rifle, a second identical bullet is dropped from the exact same height as the bullet leaving the mouth of the gun. What will happen and why?
- The time that it takes the first bullet to drop will depend on its speed when it left the gun.
 - The fired bullet will hit the ground before the dropped one because it is going faster.
 - The bullet that is dropped straight down will hit the ground first because it travels in a straight line.
 - The bullets will both hit the ground at the same time because gravity is the same for both.

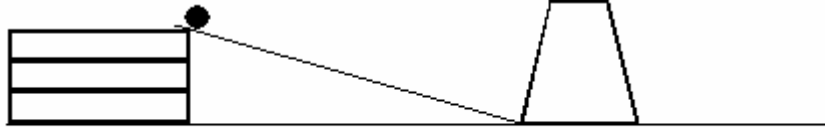
- _____ 5. You plan on using the reaction of crushed Alka-Seltzer® (a commercial antacid) in water to show the effect of reactant particle size on the rate of a chemical reaction. Which of the following conditions should be employed for this experiment?
- The temperature of the water must be the same in each test.
 - Different amounts of Alka-Seltzer® should be used for each test.
 - The mass of the Alka-Seltzer® in each container should vary inversely to the size of the particles.
 - The amount of water used should vary proportionately with the size of the particles.
- _____ 6. The tremendous output of energy from stars originates deep in their interiors due to
- nuclear explosions.
 - nuclear fusion.
 - nuclear fission.
 - chemical reactions.
- _____ 7. To compute the average speed of an object, you need to know its
- direction and time interval traveled.
 - mass and acceleration.
 - distance and time interval traveled.
 - momentum and direction at that point.
- _____ 8. In a mixture made by dissolving salt in water, water is identified by which scientific term?
- substance
 - solvent
 - solute
 - solution
- _____ 9. The periodic table of the elements is arranged so that elements (ignoring the transition metals) in a vertical column
- have the same number of protons as each other.
 - tend to combine easily with each other.
 - exhibit similar reactivity as each other.
 - have the same number of electron shells as each other.

10. A student says “It is easier to lift a heavy rock with a long lever because the long lever allows more energy to transfer to the rock than the energy you put in at the handle.” Why is this a misconception?
- The misconception is that the energy transfer is the key concept when in fact it is the power that is the critical concept for this situation. The long lever amplifies the power applied to the rock which is why it is useful in this scenario.
 - The misconception is that the energy transfer is the key concept to lifting the heavy rock in this scenario. Instead, the advantage of the long lever is that it permits a much better grip on the handle for both hands so that no energy is lost in slippage.
 - There is more energy transferred to the rock; the misconception is that this is a function of the length of the lever. Any length lever will transfer more energy to the rock, but the advantage of the long lever is that it gives you more leverage for this energy transfer.
 - The misconception is that energy is amplified when actually the energy output is essentially equal to the energy input. The advantage gained is that more force is available with the longer lever, but at the expense of greater travel distance needed.
11. Students are assigned the task of designing electrical circuits with prescribed properties in a laboratory activity. In which of the following wiring diagrams with three identical bulbs and a power source would BOTH other bulbs stay lit if bulb #2 burned out?

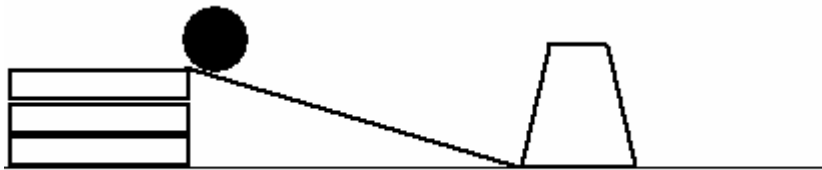


- Circuits A, B, and C.
- Circuits A and C.
- Circuits B and C.
- Circuits A and B.

- ___ 12. The diagrams below each show a board propped up on a stack of 3 equal-sized blocks; demonstration 1 uses a small marble and demonstration 2 uses a ball that is four times heavier. Your students are designing an experiment to test which coefficient of friction with the tabletop is higher, that of a plastic cup or of a styrofoam cup of equal weight. Which experimental procedure would allow the students to answer this question?



Demonstration 1



Demonstration 2

- a. Test the plastic cup with demonstration 1, and then exchange it with the styrofoam cup for the next trial, to control for the other possible variables that may affect experimental results.
 - b. Test the plastic cup in demonstration 1 and the styrofoam cup in demonstration 2 because the greater frictional force of styrofoam will need a larger force to overcome it.
 - c. Test the plastic cup in demonstration 1 and test the styrofoam cup by adding a block to the ramp in demonstration 1 and using the same marble to control for different sized balls.
 - d. Put the plastic cup in front of the styrofoam cup at the bottom of ramp 2, and then exchange their places for the next trial, so that the large ball causes both of them to move simultaneously.
- ___ 13. As water changes phase from a liquid to a solid,
- a. its temperature falls.
 - b. vibrations between molecules are slower and slower.
 - c. vibrations between molecules are faster and faster.
 - d. it loses volume.
- ___ 14. In a laboratory experiment, you would like to compare the electrical conductivity of aluminum, steel, and tin wires. You plan on using each wire connected in parallel to a voltage source (e.g. a 9-volt battery) with an identical ammeter in each branch to measure current. Which of the following is NOT necessary for this experiment?
- a. The ammeters should be protected from nearby magnets.
 - b. The wires must all be the same length.
 - c. The wires must all come from the same supplier.
 - d. The wires must all be the same diameter.

- ____ 15. You would like to compare the thermal conductivity of copper, tin and aluminum. You plan on putting equal amounts of water in copper, tin and aluminum containers of equal volume, shape, and thickness. You will then simultaneously subject them to identical heat sources and measure the temperature of the water in each container after 5 minutes.
In this experiment, the types of metal used to make the containers represent
- control variables.
 - independent variables.
 - dependent variables.
 - outcome variables.
- ____ 16. Air conditioners (AC) in cars often seem to be leaking water when a car parks after having had the air conditioning on for a while. The reason for this water is
- the AC cools the air significantly, and the colder air can't hold as much moisture so the moisture condenses out of the colder air and drips onto the ground.
 - the AC cools the air by passing it through water, and the leak is the excess water left from this process.
 - the AC evaporates water vapor from the air in order to cool it, and some of this excess water vapor drips onto the ground.
 - the AC chemically separates the air gases (primarily oxygen and nitrogen) from the chemically distinct water (H_2O) and eliminates the water by letting it drip onto the ground.
- ____ 17. During a lab activity, a student notices that a triangular glass prism put into the overhead projector light creates a small rainbow on the wall. She proposes that this is possible because the overhead projector has a mirror that reflects an image from a transparency onto the wall. To investigate this hypothesis, the teacher could lead students to develop an investigation with the following characteristics:
- Experiment with triangular prisms made out of different translucent materials to be put into the overhead light to determine if they can produce rainbows.
 - Experiment with putting the triangular shaped prism into different light sources reflected off a mirror, such as sunlight and incandescent lamps, to see if it can produce a rainbow.
 - Experiment with the triangular prism in the overhead projector light with the mirror removed to determine if it can produce rainbows.
 - Experiment with differently shaped prisms in the overhead light to determine which shapes can produce a rainbow.
- ____ 18. Kinetic energy can be defined as
- bonding energy.
 - gravitational energy.
 - motion energy.
 - stored energy.

- _____ 19. One of the primary factors contributing to the frictional force on an object on a floor is the object's
- volume.
 - surface area touching the floor.
 - weight.
 - shape.
- _____ 20. Many amusement park rides give people a thrill by whirling them in circles. Part of the thrill of these rides is the sensation that your body is being thrown out against the outer wall of the ride. Why does whirling in a circle create this sensation of being thrown outward?
- The circular motion of the ride changes the direction of gravitational acceleration so that gravity pushes you to the outside of the ride's wall when it is rotating at a high speed.
 - A person's body has inertia which resists a change in direction, but the circular motion of the seat you are riding in means that the outside wall of the seat must constantly push against your body to keep changing your body's direction.
 - A centrifugal force is an additional force created by the circular motion which pushes all objects away from the center of rotation and toward the outside walls of the ride.
 - A new force is added to the gravitational force because of the circular motion, and these two forces working together create the sensation that you are being pushed toward the outer wall of the ride.

Open Response Directions

Write responses to parts (a) and (b) in the space provided. If more space is needed, please use the back of the paper and indicate that your response continues on the back.

Directions for part (a):

In each question, students expressed a misconception. Please describe the currently accepted scientific explanation of the phenomenon that the students are not understanding. Explain the science in as much depth as possible, even if that level of depth would be inappropriate to expect middle school students to know. Your explanation should demonstrate a thorough knowledge of the underlying science – simply stating the opposite of the students' misconception without further explanation is not sufficient.

Directions for part (b):

Explain how you would address this misconception using best instructional practices. Please describe the classroom instruction, including what the students and teacher are doing, in enough detail so that the reader can envision what is happening. For example, if you refer to a specific lesson, textbook, activity, piece of equipment, or media, assume the reader is not familiar with it and explain how it is used to support student learning. Assume you have access to any equipment that would be available in a reasonably well-funded K-12 school setting so that your proposed instruction is feasible to implement.

