Name: Date: Period #:

Seventh-grade science

**Systems thinking practice, study, and preparation sheet**

**Test:**Monday, August 29th

The questions will be the same as the questions on the pretest. These are included in today’s lesson. Make sure you are giving seventh-grade answers using the information and strategies we have discussed over the last two weeks. One way to study is to retake the practice test, then look over the work we have done and correct and improve your own answers. Then study from that.

**What do we know about systems?**

Systems are things made of parts and possibly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, usually to perform one or more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  The parts/subsystems that interact are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  The interactions can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Systems have some organization and often patterns in the way they work and/or change.  Because all systems in the universe are in some way connected, and because it is impossible to consider all the factors in the universe when systems thinking, it is good to define the system by giving it a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in space and possibly time.

Things called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ go into the system and are changed.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are produced and can leave the system or feed back into the system and cause change in the system.  A cycling pattern of interactions within a system is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  Energy is involved in the changes.

Some systems can reach an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ where they are in balance and the outcomes can be more predictable.

**Systems are everywhere!** We thought of many examples of systems: ecosystems, transportation systems, mechanical systems, and systems within our body such as the digestive and circulatory systems. You are a system and this class is a system. Each one of us is a subsystem within the class system. How we act, our presence in the classroom, and even our absence has an impact on the class system.

**Systems thinking** helps us to identify the systems all around us and helps us to solve problems when something is not working with systems, or when we want to try to make systems work better.

When using systems thinking skills to explore any system, consider the big picture. What is the ultimate (final) goal? Who is influencing the system? Who or what is being influenced by the system? Who gets to decide what is best for the system?

Realize that there are different perspectives. Look at problems from different points of view and consider that other people may have different background information and experience that may influence how they see the problem and which solutions may work best for them.

When variables interact, the direct and indirect effects may not be noticed immediately. Some interactions take time to develop and some may just be invisible. That doesn’t mean they aren’t important to the system. They may have major impacts, especially as they move past **tipping points**. For example, a stream can have more or less water, but once it overflows its banks, the impacts change. Tipping points are game changers and may cause the need to rethink the system and its interactions.

Systems thinking prevents us from jumping to conclusions and making decisions without considering all the indirect and long-term effects of our actions. It is important to consider the big picture of the problem you are trying to solve and make the best decision you can.

**What are some of the logical steps included in systems thinking?**

1. Identify the problem.  Sometimes this is given; sometimes it is uncovered while studying a system.
2. Identify the system involved with that problem and define the boundaries (time and space).
3. Identify the function(s)/role(s) of the system.
4. Identify the parts and subsystems (variables) of the system.
5. Identify the functions and interactions/relationships (direct and indirect).
6. Identify sequences and patterns.
7. Identify how your system changes over time.
8. Identify how the system interacts with other systems.
9. Construct a systems diagram focusing on the problem.
10. Identify possible solutions.
11. Test the solution using your systems diagram. (If I do \_\_\_\_\_\_, what effect will it have, not only on what I am hoping it will “fix,” but also on other parts of the system and on systems to the system being studied.  You want to make sure the solution you choose does not have a negative effect you don’t want on other parts of the system.

**Circle the variables below that are part of our campus creek system.**

|  |  |  |  |
| --- | --- | --- | --- |
| water | fish | Sun | snakes |
| gravity | fossil pit | the PAC | the landscapers |
| rain | gym parking lot | crawfish | native plants |
| relief (slope) | raccoons | invasive plants | rocks |
| soccer field | spiders | trash | sand |

**What are some variables of the variables in our campus creek system not mentioned above?**

**What are some of the functions/roles of our campus creek system?**

1. Flood prevention
2. Aesthetics (pretty so people can enjoy looking at it)
3. Habitat for wildlife
4. Recreation:
   1. Cooling off in the creek/splash fun
   2. Looking for animals in the creek
   3. Fishing (This is not recreation for the fish!)
5. Education:
   1. Observation
   2. Ecosystems
   3. Water chemistry
6. Food and Water (aquifer) for people

**What are steps you can take to figure out how to improve the creek?**

1. Identify what you want to improve.
2. Identify the boundaries, inputs, and outputs of the system in which the changes will take place.
3. Identify the interactions within the system.
4. Draw a diagram.
5. Identify potential solutions
6. Test your solutions using your diagram.
7. Select the “best” solution/solutions.
8. Record your plan of action.

Note:  This is a simplified version of the steps to systems thinking.  For seventh grade, this is fine.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Handout answers  **What do we know about systems?**  *Systems* are things made of parts and possibly subsystems that interact, usually to perform one or more functions.  The parts/subsystems that interact are variables.  The interactions can be direct or indirect.  (It does not matter if you reversed the order and wrote indirect/direct.)  Systems have some organization and often patterns in the way they work and/or change.  Since all systems in the universe are in some way connected, and since it is impossible to consider all the factors in the universe when systems thinking, it is good to define the system by giving it a boundary in space and possibly time.  Things called *inputs* go into the system and are changed.  Outputs are produced and can leave the system or feed back into the system and cause change in the system.  A cycling pattern of interactions within a system is called a *feedback loop*.  Energy is involved in the changes.  Some systems can reach an equilibrium where they are in balance and the outcomes can be more predictable.  **Circle the variables below that are part of the Tumblin’ Creek system that exists on PKY property.**   |  |  |  |  | | --- | --- | --- | --- | | water | fish | sun | snakes | | Gravity: We decided it is a part of the system, but not a variable because it does not change | fossil pit | the PAC | the landscapers | | rain | gym parking lot  (depends on if it drains into the creek) | crawfish | native plants | | relief (slope) | raccoons | invasive plants | rocks | | soccer field (depends on if it drains into the creek) | spiders | trash | sand |   **What are some variables of our creek system not mentioned above?**  concrete/sand bags, opossums, turtles, dirt, pipes, concrete drain-ways, and more |